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IMPORTANT ANATOMICAL DATA OF THE DIGESTIVE TRACT[1]

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KNOWLEDGE of certain anatomical facts concerning the various parts of the digestive tract is very essential, both to an understanding of the findings observed, and for an intelligent and accurate application of the roentgenologic method of examination in eliciting the information that is desired. In the following section it is not our intention to review completely the anatomy of the digestive tract, but, rather, to point out the essential anatomical facts, some of which are common knowledge, but others of which are seldom, if ever, referred to in the standard or even in the special textbooks of anatomy.

Anatomy of the Esophagus.—The esophagus is a musculo-muco-membranous canal which extends from the pharynx to the stomach. The anatomical relations of the esophagus as observed roentgenologically are illustrated in Figure 20. It commences superiorly at the upper, posterior border of the cricoid cartilage, and terminates inferiorly about from 3 to 5 cm. below the diaphragm at the cardiac orifice of the stomach. The esophagus descends along the front of the vertebral column, and, except in the cervical region and abdomen, lies in the posterior mediastinum. In the cervical region the esophagus lies between the vertebral column and the larynx and trachea. In the thorax it lies in close relation anteriorly from above downward with the trachea, the left main bronchus, and the pericardium, *i.e.*, the posterior surface of the heart. The anterior part of the arch of the aorta is in front of the esophagus and is separated from it by the trachea; but in the upper mediastinum the terminal (posterior) part of the arch of the aorta is in contact with the left side of the esophagus.

The general direction of the esophagus is vertical, but it presents several lateral curves and also slight anteroposterior curves corresponding to the curvature of the cervical and thoracic portions of the vertebral column. The lateral curves are more marked when the individual is in the recumbent posture, due to the release of the tension on the esophagus which is present when one is erect. As regards the lateral curves, the esophagus at its commencement

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is in the median line, but inclines to the left in the lower cervical region so that it lies partially behind the left lobe of the thyroid. In the upper thorax the esophagus gradually passes to the mid-line again, and in the lower thorax, about 5 cm. above the diaphragm, it inclines to the left and forward away from the vertebral column. Below the diaphragm it still inclines forward and to the left to join the stomach.

The caliber of the lumen of the esophagus varies with the presence or absence of swallowed substances, and varies considerably with the size of the bolus passing through it. The caliber is also anatomically somewhat irregular. Many points of narrowing have been described, but those of chief importance are at the introitus, at the level of the aortic arch, at the crossing of the left bronchus, at the level of passage through the diaphragm, and at its termination—the cardiac orifice of the stomach.

The close relation of the esophagus to the posterior part of the arch of the aorta in the upper mediastinum, and the posterior surface of the heart below the level of the bifurcation of the trachea, is of considerable importance. Changes in size and shape of these parts of the heart and aorta are directly reflected in displacement of and pressure on the esophagus. Therefore, roentgenographic examination of the esophagus when filled with an opaque substance, maps out accurately the contour of these parts of the heart and aorta.

The abdominal portion of the esophagus is of smaller caliber than the rest of the esophagus. This portion may be somewhat conical in shape, with its base toward the stomach, particularly when a small bolus is temporarily lodged in the esophagus between the level of the diaphragm and the stomach. Roentgenographically and anatomically (Moser) the esophagus at the hiatus esophageus of the diaphragm often shows the impression of the left crux of the diaphragm. The so-called cardiospasms involving the esophagus are not limited to the junction of the stomach and esophagus, but extend throughout the lower end of the esophagus from the cardiac orifice to a point about one-half inch above the left crux of the diaphragm.

The esophagus has five coats—an internal or mucous coat, a muscularis mucosæ, a submucous coat, a muscular coat, and an external or fibrous coat (see Fig. 21). The mucous coat is covered throughout with a thick layer of stratified pavement epithelium. Between the mucosa and the submucosa is the muscularis mucosæ, a layer of longitudinally arranged smooth muscle tissue. The submucosa is a loose areolar connective tissue which connects loosely the mucous and muscular coats. The esophageal glands, which lie in the submucosa, are small compound racemose glands of the mucous type. The muscle coat (muscularis propria) is composed of two layers of smooth muscle of considerable thickness. The muscle fibers of the inner layer are arranged circularly, and the fibers of the outer layer are arranged longitudinally.

When empty, the esophagus is contracted and its anterior and posterior walls come in contact. The inelastic mucous membrane folds longitudinally (Fig. 33), so that on transverse section the lumen of the contracted esophagus is stellate in form (flattened anteroposteriorly).

Roentgenographic examinations have shown that the esophagus normally

does not contain air. However, we not infrequently observe, when a bolus of barium paste is swallowed, that a cylindrical bubble of air is forced down ahead of the bolus. This bubble of air may pass into the stomach, or, after reaching the lower end of the esophagus, the air bubble may pass up along one side of the barium (Figs. 22 and 23). It is important not to consider these air bubbles as filling defects in the wall of the esophagus. The shift in position of the air bubble is usually sufficient protection against an erroneous interpretation.

Partial herniation of the stomach through the hiatus esophageus is a not infrequent anomaly, and a persistent air bubble in the digestive tract just above the left crux of the diaphragm is usually due to this condition.

Anatomy of the Stomach.—For the sake of simplicity of description, the stomach may be considered as divided into four chambers, the fornix, corpus, antrum, and cap, by three partitions, the pyloric valve, sulcus angularis, and corporic shelf. This is somewhat similar to Forssell's division of the stomach. Each of these regions will be considered, in the order named.

Fornix.—The fornix is indicated in the schematic drawings (Figs. 26 and 27) by horizontal parallel lines. For the purpose of roentgenologic exploration, it may be filled with air or barium. When filled to complete distention, it conforms with the dome of the diaphragm, an excellent reason for terming this region the "dome" of the stomach. This conveys its shape to every one wherever the English language is spoken, whereas most of us must turn to the dictionary for the origin, or meaning, of the term "fornix."

Corpus.—The corpus, or body, of the stomach is indicated by vertical parallel lines in Figures 26 and 27. It is the largest and most distensible chamber of the stomach. With the patient in the erect posture it forms a vertical column, the right side of which extends from the esophagus to the sulcus angularis, and the left side of which extends to the most dependent portion of the greater curvature. When completely filled, the corpus is free of rugæ: when it is empty, or partly filled, the mucosa is thrown into folds or rugæ (Figs. 33, 34, and 35).

Antrum.—The antrum is indicated in Figures 26 and 27 by oblique parallel lines, and is that portion of the stomach between the sulcus angularis and the pyloric valve. When distended it is egg-shaped, with the small end of the egg lying toward the pyloric valve; and it is free of rugæ, so that the mucosal surface, as observed roentgenographically, is smooth. During a short period of each gastric cycle the distal end of the antrum is contracted by the fan-shaped pyloric muscle into a pyloric canal, which is indicated by cross-hatching in Figure 27. During this period the mucosa of this region is thrown into characteristic folds.

Cap.—The cap, which we shall subsequently consider as a separate organ, may be included here as a fourth chamber of the stomach. (It is indicated by dots in schematic Figures 26 and 27.) It is bounded proximally by the pyloric valve, and distally by the first of the valvulæ conniventes that are so characteristic of all portions of the small intestine. When the cap is distended it corresponds in size and shape to the pyloric antrum and sets upon the latter

like a brimless cap, or *beret*. If the partition between the antrum and cap is obscured by a pencil, the significance of the cap, as relating to the stomach rather than to the small intestine, becomes apparent. When the cap is distended it is singularly free of rugæ; when contracted, its mucosa has a characteristic appearance. The mucosal pattern of the cap is somewhat similar to that of the stomach, but it differs radically from that of the duodenum and all other portions of the small intestine.

Pyloric Valve.—On roentgenologic exploration, the lumen of the cap is found to be separated from the lumen of the antrum by a clear-cut, well defined space about 3/16ths of an inch (0.5 cm.) in length (longitudinal axis of the gut). The length of this space may vary slightly with different cases and with different phases of the cycle of gastric peristalsis, but it is one of the most definite findings in the entire gastro-intestinal tract, and, roentgenologically, is the monumental landmark from which to measure in either direction. It serves as one of the best illustrations for the demonstration of our second fundamental finding, namely, the muco-membranous fold viewed on edge (Figs. 31, 37, and 52).

Sulcus Angularis.—The antrum is separated from the corpus by a less definite partition located at the point of the incisura angularis. This partition, although varying considerably in length, is markedly constant in its thickness, as illustrated by Figures 32 and 51. This partition also serves to illustrate the second fundamental finding. The base of the sulcus angularis is opposite the recedent angle or incisura angularis, which may be observed on the outside of the stomach.

Corporic Shelf.—The corpus is separated from the fornix by a less definite partition, the corporic shelf, that occurs about on a level with the esophageal orifice (Figs. 28 and 29). This corporic shelf is not a constant roentgenologic finding.

Variation in Shape of the Stomach during a Single Cycle of the Complex Gastric Motor Phenomenon.—The stomach goes through a series of shapes and comes back to its original shape about once in twenty seconds. This recurrent series of events is known as a "gastric cycle," ten stages of which are shown in Figure 30. The gastric cycle, like the cardiac cycle, has a systolic and diastolic phase. Likewise, similar to the asynchronous systole and diastole of the auricles and ventricles of the heart, there is an asynchronous systole and diastole of two divisions of the stomach, the first of these functional divisions being the corpus and the proximal part of the antrum, and the second being the pyloric canal. During systole of the first or superior division, termed "systole of the stomach," peristaltic waves of contraction form, and simultaneously the contractions become deeper and progress toward the distal end of the stomach. During *early diastole* the waves of contraction continue to progress distally, but they gradually become more and more shallow, until in *mid-diastole* each wave of contraction disappears or becomes most shallow after having progressed distally to the point of origin of the neighboring wave. During the *latter half* of diastole the peristaltic contractions are at their minimum.

Systole and diastole of the pyloric canal is a function of the fan-shaped pyloric muscle. During systole this muscle contracts concentrically to the long axis of the pyloric canal. At the onset of diastole, relaxation of this muscle is rapid and causes the appearance of the anti-peristalsis described by Alvarez. Systole of the pyloric canal occurs during the period of diastole of the upper division of the stomach, and diastole of the pyloric canal occurs just after the onset of systole of the upper division. Two of the ten phases of the gastric cycle have been selected to illustrate the lumen of the stomach—one with the upper division of the stomach in systole (Fig. 31), and the other with the pyloric canal in systole (Fig. 32). These are also illustrated in the line drawings in Figures 26 and 27. Approximately one and one-half gastric cycles are recorded in the roentgenocinematographic series, Figure 15.

Small Intestine.—The small intestine begins at the first plica circularis observed in the duodenum and terminates at the ileocecal valve. There are two main divisions of the small intestine: (1) the duodenum, which is largely retroperitoneal in position and relatively fixed; (2) the mesenteric small intestine, which is interperitoneal and, because of its mesentery, relatively movable.

On the basis of relative differences in the mucosa the mesenteric small intestine has been further divided into the jejunum, which is proximal, and the ileum, which is distal. Although the difference in the mucosa of the proximal part of the small intestine and the distal part of the small intestine is marked, there is no abrupt dividing line and the transition from characteristic jejunum to characteristic ileum is gradual. This division of mesenteric small intestine into jejunum and ileum does not, apparently, have a good anatomical basis. Most anatomists prefer to speak of this part of the small intestine as a unit, calling it either the jejuno-ileum or, preferably, the mesenteric small intestine.

During a detailed roentgenographic study of the small intestine, a report of which was published in 1927, we had noticed in the great majority of individuals that the small intestine was arranged in a definite pattern of groups of coils. We were not satisfied with the usual classification of the small intestine into jejunum and ileum, because of the absence of any sharp difference between those regions of the small intestine which are supposed to show the greatest variation, namely, the small intestine near the duodeno-jejunal flexure, and the small intestine near the ileocecal valve. We were considering a division of the small intestine according to its arrangement into groups of coils when we learned that such a classification was entirely logical, in that the small intestine develops in the embryo in this manner, and at a very early stage of development shows this typical arrangement into groups of coils. At this time we had not recognized that the loops of the duodenum represented part of this general arrangement. C. M. Jackson, in his section on the digestive system in Morris's "Human Anatomy," states as follows: "Even in an embryo of 19 mm., while the intestine is still in the umbilical celom, Mall described six primary coils of the small intestine which could be usually identified even in the adult. In the adult, as also through the various stages of development, Loop 1 forms the duodenum." From our own studies

we believe that the groups of intestinal coils developing from these six primary coils can be recognized roentgenographically (Fig. 38). The first loop (Fig. 39) is the duodenum and should be known under that name. The second, third, fourth, fifth, and sixth groups of coils are the mesenteric small intestine. We believe that these several groups of coils can be recognized roentgenographically and that any roentgenologic division of the mesenteric small intestine should be on this basis of development.

Duodenum.—We consider that the duodenum begins at the first crescentic or annular fold of the mucosa distal to the cap, and extends to the duodeno-jejunal flexure. The duodenum is relatively fixed in position in the form of a loop, the opening of the loop facing to the left and superiorly. The concavity of the loop encircles the head of the pancreas and corresponds in size to it. There are several normal shapes of the loop of the duodenum. Depending upon the relative position and angulation of the superior, descending and inferior parts, the duodenum may be shaped like the capital letters "C," "V," or "U," or may be almost rectangular in shape.

The superior or first part of the duodenum, not the cap, is not retroperitoneal and is usually short. It is best visualized in the right oblique projection (Fig. 48). This superior part of the duodenum passes from the distal end of the cap posteriorly and usually superiorly and to the right. The angle at the inferior margin of the junction between the cap and superior duodenum may be obtuse or acute. The more the stomach is raised upward and forward by the abdominal contents, the more obtuse is the angle. In marked elevation of the stomach or in the short typical hypersthenic type of stomach, the cap may point inferiorly into the superior duodenum. This is inversion of the cap. The superior duodenum may be long and occasionally forms a loop inferiorly (Fig. 48), the cap and the upper end of the descending duodenum forming the two points of suspension. The folds of the mucosa within the short superior duodenum are usually low in height and few in number. This relative absence of folds is particularly noticeable when the superior duodenum is long and redundant. The superimposition, partial or complete, of a redundant superior duodenum over the cap, as occurs in the anteroposterior projection, produces an irregular shadow which may closely simulate a deformity of the cap due to ulcer (Fig. 47).

The descending and inferior parts of the duodenum are relatively fixed in position. This fixation is, however, more relative than absolute, and the position and form of the duodenum usually differ in the prone and erect postures of the individual. The anterior and lateral walls of the duodenum are covered by peritoneum, protrude into the peritoneal cavity, and are relatively free. For this reason the contour will vary considerably with varying degrees of filling. The transverse mesocolon crosses the middle of the descending duodenum, and at this level one not infrequently sees deformation and angulation of the descending duodenum (Figs. 49 and 50). This is a congenital malformation acquired at the time that rotation and fixation of the colon occurred.

Duodeno-jejunal Flexure.—This is usually the highest fixed point of the

small intestine. The inferior duodenum usually ascends to the flexure. The flexure is suspended by the fibromuscular ligament of Treitz which passes down behind the pancreas from the lumbar part of the diaphragm. Very rarely one finds an abnormal location of the duodeno-jejunal flexure, in which case fixation has usually occurred lower in position, somewhere along the normal course of the inferior duodenum.

The intestine is only occasionally held to a point at the duodeno-jejunal flexure. Usually it makes a moderate curve on itself, and less commonly the curve is very wide. The curve at the flexure is usually from posterior to anterior, and for this reason, in many individuals, the angle of the curve can be appreciated best when it is viewed in the oblique or lateral direction. From the duodeno-jejunal flexure the intestine passes forward and usually inferiorly toward either the right or left side. This first loop of the mesenteric small intestine is more commonly directed inferiorly, or inferiorly and to the left, than it is toward the right side. Occasionally the intestine, a short distance distal to the flexure, is caught up at a second point of fixation, forming a short loop.

Mesenteric Small Intestine.—The second group of coils, which forms the first part of the mesenteric small intestine, is usually located in the left hypochondrium and the loops may ascend above the level of the duodeno-jejunal flexure (Fig. 40). The third group of coils is usually located in the left lumbar region and the loops may descend below the plane through the level of the superior iliac spines (Fig. 41). Almost uniformly, both of these groups extend slightly beyond the right side of the spine. It is uncommon, however, to observe several loops of these groups in the right hypochondriac regions. The various loops of these groups are usually quite discrete, particularly when they are widely distributed in the abdomen. Only when they are confined within a relatively small area are they massed together so that the individual loops cannot be recognized.

The fourth group of coils is usually found in the umbilical and upper hypogastric regions (Fig. 42). The fifth group of coils is usually observed in the right lumbar region (Fig. 43) and the sixth group of coils is usually located in the right iliac fossa and the false pelvis, or lower hypogastric region (Figs. 44 and 45). Distinct visualization of the separate loops of the fourth, fifth, and sixth groups largely depends upon their position in the abdomen. If most of the loops are out of the pelvis, they can be individually recognized. When the loops are grouped together in the pelvis they may be so massed together that it is impossible to recognize their outlines. Upward displacement of the intestines by a filled urinary bladder also tends to mass the loops together. This tendency in many individuals for the groups of coils to be massed together is the most serious obstacle we have encountered in attempting accurately to visualize the small intestine.

There is also a characteristic arrangement of the intestinal loops within the groups of coils. In the second and third groups of coils the individual loops lie transversely in the abdomen, and in the fourth, fifth, and sixth groups the individual loops lie vertically. Between each group of coils a rela-

tively longer loop of small intestine extends back to the root of the mesentery. This formation is most characteristically seen between the second and third groups of coils (Figs. 39 and 40).

Displacement of the first and second groups of coils into the right hypochondrium and lumbar region is the rule in association with incomplete rotation of the colon. Rarely it occurs as an isolated abnormality. In both instances the duodeno-jejunal flexure may be displaced out of its usual position. Another unusual anomaly is to have the upper loops of the mesenteric small intestine festooned across the upper abdomen.

The surface of the mucosa of the small intestine is characterized by the presence of numerous circular, spiral, and crescentic folds. These folds, which are most commonly called the plicæ circulares, are found throughout the small intestine but are most numerous and of greater height in the duodenum and first loops of the mesenteric small intestine. They diminish somewhat in height and number through the fourth and fifth groups of coils. In the sixth group of coils they are short and less numerous and may be absent in the terminal part. The folds are possibly of two types: (1) the permanent folds, that is, those which persist during distention of the intestine and persist in the anatomical specimen (these are a duplication of the mucosa and muscularis mucosæ, bound together by the submucosa); (2) those folds which are due to temporary contraction of the muscularis mucosæ. Forssell has called attention to the varying form of the folds of the duodenum and ascribes this to varying contraction of the muscularis mucosæ. More recently Forssell has brought forward a more complicated theory regarding the movements of the mucosa which shall be discussed at a more appropriate time.

Caliber of the Lumen of the Small Intestine.—In the living subject the intestine is normally in a state of tonic contraction—it is contracted on itself or its contents. For this reason the caliber of the lumen of any section of the small intestine will depend largely upon the degree of filling or distention. Certain normal variations in the rapidity of emptying of the stomach and the rapidity of passage of the meal through the small intestine will, therefore, modify the distribution of the meal and the appearance of the intestine. Rapid uniform emptying of the stomach will give a large caliber to the intestine throughout the entire length in which the meal is present. With slow or moderately rapid emptying of the stomach the caliber of the lumen of the intestine will be small or moderate, if the passage of the meal through the intestine keeps pace with the emptying of the stomach. If the passage of the meal through the intestine is more rapid than the entrance of the meal into the intestine, the caliber will be small, but usually uniform. If the stomach empties itself intermittently, the distribution of the meal and the caliber of the small intestine will be irregular.

Ileocecal Valve.—The small intestine opens into the colon through the ileocecal valve, usually situated on the left posterior side of the proximal end of the colon, and marking the dividing line of the cecum and ascending colon. The valve has two lips, one superior and one inferior. From the anterior and posterior margins of the valve, where the lips meet, a fold (frenulum) which

protrudes into the lumen of the gut, extends partially around the inside of the colon. The indentation of the barium column produced by these folds is not infrequently observed in the roentgenograms of this region. The roentgenographic appearance of the lumen of the open valve as viewed in the postero-anterior direction is illustrated in Figure 46.

Coats of the Stomach and Small Intestine.—As we stated in a recent communication (1928), dealing with the gross morphology of the living stomach and the microscopic anatomy of the stomach (with some reference to the cap), all portions of the gastro-intestinal tract have been described by anatomists as having five coats, namely, (1) mucosa, (2) muscularis mucosæ, (3) submucosa, (4) muscular coat (composed of two or three layers), and (5) the serous coat. These coats differ in thickness and characteristics in various regions of the stomach. In the small intestine their histologic structures vary in different portions to a less degree than in the stomach. Strangely enough, in the last two decades the cap—although the subject of a great deal of controversy—has escaped an intensive investigation of its gross and microscopic anatomical structure, particularly the peculiarities of structure as compared with those of adjacent regions. In the cap there are only three coats. It is very important to have a thorough understanding of the anatomical characteristics of each of these coats in the various regions.

In the stomach (Fig. 51) the mucosa is packed closely with tubular glands. The muscularis mucosæ is a well defined coat firmly fixed to the bases of the tubular glands of the mucosa, and in places continuous with slips of muscle tissue which extend in between the tubular glands. The submucosa has a loose areolar character, permitting the free movement of the mucosa on the regular muscle coat. It is rich in a vascular network that supplies blood to the mucosa on the one side, and to the muscular coat on the other. The muscular coat is very thin in some regions and extremely thick in others. The serous coat is firmly attached to the muscular coat except on the greater and lesser curvatures, but it is important to note that the serous coat draws its blood supply from vessels totally different from those which provide blood to the underlying muscular coat.

Both the sulcus angularis and the pyloric valve are thin muco-membraneous folds which consist of mucosa, the muscularis mucosæ, and submucosa. The thickness at the base of both the sulcus angularis and the pyloric valve is just sufficient to contain two layers of mucosa, two layers of muscularis mucosæ, and a core of submucosa. It is obviously impossible for them to contain the definitely thickened fibers of the circular muscular coat of the stomach. Closure of the pyloric valve is caused by a circular contraction of the muscularis mucosæ (Fig. 52). The pyloric valve is not controlled by any specialized pyloric sphincter derived from the circular layer of the muscularis propria. The circular fibers of the muscularis propria terminate just at the base of the pyloric valve, and during the stage of relaxation the distal edge of this thickened muscle is contiguous with the base of the pyloric valve, but does not project down into the valve.

At the junction of the cap and pyloric valve, that is, at the distal side of

the pyloric valve, there is an abrupt change in all of the coats (Fig. 52). The mucosa with its characteristics of the pyloric antrum covers both the proximal and distal surfaces of the pyloric valve, and the antral characteristics of the mucosa terminate suddenly at the base of the cap, where the deep tubules of Brunner's glands replace the bulk of the loose areolar submucosa. The muscularis mucosæ terminates abruptly as a continuous layer, and splits up into thin strands which are lost in the connective tissue stroma between the straight superficial stalks of the glands and their deeper convoluted racemose tubules.

As compared with the stomach, the muscularis propria of the cap is thin and incomplete. It is composed largely of longitudinal fibers which are a continuation of the longitudinal muscle coat of the stomach. The circular layer of the muscularis propria of the stomach terminates at the distal end of the thick fan-shaped muscle of the pyloric canal. Distal to this there is no circular layer of muscle until about the middle of the cap.

The junction of the cap and small intestine (duodenum) is marked by the first annular or crescentic fold (plica circularis) distal to the pyloric valve. The loose, areolar submucosa and the muscularis mucosæ are re-established at this point, which allows folds of the mucosa to form by contraction of the muscularis mucosæ. The number of coats in the small intestine is also five, and they are arranged similarly to those of the stomach, without, however, as stated above, as much variation in their structure.

In the cap, therefore, the structure of the wall of the gut differs considerably from the structure of the wall of the stomach and small intestine (Fig. 53). The submucosa as a loose areolar structure and the muscularis mucosæ are absent, being replaced by the bulky racemose convoluted glands of Brunner, and these glands lie in direct contact with the inner surface of the muscular coat. Because of the absence of a loose areolar submucosa the mucosa is relatively immovable upon the muscle coat. The muscularis propria of the cap is relatively thin, particularly in a local region which completely encircles the cap about one-fourth of an inch distal to the pyloric valve. In this local region (Fig. 52, X) the muscular coat is diminished from 40 to 98 per cent, leaving in some cases only 2 per cent of muscle, according to Howell. On the ventral surface of the cap the peritoneum is tightly adherent to the muscularis propria. Posteriorly, a space similar to the intraperitoneal gastric triangle is present between the dorsal surface of the cap and the descending duodenum. The blood supply of the cap is derived from both the pyloric branch of the right gastric artery and the gastroduodenal artery. The branches of both of these arteries terminate in end arteries, (1) in the local region just distal to the pyloric valve where the muscle coat is extremely thin, (2) in the pyloric valve itself, and (3) in the extreme distal end of the pyloric canal, just proximal to the valve.

It would appear from the peculiar characteristics of this local region of the cap, namely, an area from which two coats are absent (muscularis mucosæ and submucosa), where the musculature is thinner than in any other part of the gastro-intestinal tract, where the mucosal glands change abruptly from a

straight tubular to a racemose type of gland, and where the pyloric and duodenal arteries terminate in end arteries, that this region would present findings of more than academic interest. In fact, the anatomical structures in this region form a vulnerable ring or collar which, as indicated by the facts, represents the point of junction of the foregut and midgut during an early embryonic stage of development. The irregularities are those presented by two laminated structures improperly welded together. We regard the findings in this area as not only important from the pathologic, surgical, and roentgenologic standpoints, but also as anatomical factors predisposing to ulcer of the cap, and of great importance in the life history of ulcer of the cap.

The Colon.—The normal colon (Figs. 54–57) may be divided into six easily recognized regions, the cecum, the ascending, transverse, and descending colons, the sigmoid, and the rectum. Each has individual roentgenologic characteristics. There are two important flexures, the hepatic and splenic. The colon almost completely encircles the abdominal cavity from the situation of the cecum in the right iliac region to the situation of the rectum in the middle posterior part of the pelvis. The normal colon of all individuals conforms in general to a definite pattern or type, although every colon is prone to show some slight variation. The length of the colon varies considerably, both absolutely in different individuals and relatively in the same individual, depending upon the degree of contraction and relaxation of the colon. When the length of the colon is absolutely increased over the usual normal, the increase may be evenly distributed over the various divisions of the colon, but it is more usual for the increase in length to be limited to one or two divisions.

As regards the usual location of the various divisions of the colon, the cecum lies in the right iliac fossa. The ascending colon extends upward from the cecum along the right side of the posterior wall of the abdomen to the under surface of the liver. Here, at the hepatic flexure, the colon bends sharply forward and to the left. The next division, the transverse colon, extends to the splenic flexure. The transverse colon is festooned across the abdomen, suspended by the fixation at the hepatic and splenic flexures and through the gastro-colic ligament and mesocolon, and lies anterior to the small intestine. In the left hypochondrium at the splenic flexure the colon bends sharply posteriorly and inferiorly, from which point the descending colon passes inferiorly, lying along the left side of the posterior abdominal wall, to the left iliac fossa. There is usually no sharply defined point of transition between the descending and sigmoid colon, and for sake of clearness it is probably best to use the crest of the left ilium as the line of transition, below which the colon is termed the sigmoid colon. At approximately the brim of the true pelvis the sigmoid colon acquires a mesentery and, because it is longer than its mesenteric attachment, assumes the form of a loop. The sigmoid terminates in the rectum just below the promontory of the sacrum at the level of the body of the third sacral segment. The rectum extends inferiorly, following the curve of the sacrum, and at the floor of the pelvis bends posteriorly and passes through the floor of the pelvis as the anus.

The caliber of the colon varies directly with the volume of its contents.

The potential caliber is apparently largest in the cecum and proximal part of the ascending colon and the rectum. When the colon is evenly filled with the usual one to two liter (quart) enema, the caliber diminishes gradually from the cecum to the lower part of the sigmoid, and is then increased in the rectum.

Cecum.—The cecum is usually covered on all sides with peritoneum. The form of the cecum is variable, the most extreme variation being a long cecum which tapers directly into the appendix. The well filled normal cecum will usually show an indentation at its inferior border corresponding to the site of the anterior band of longitudinal muscle. The cecum most commonly lies in the right iliac fossa, but varies considerably and may lie above the crest of the right ilium or deep in the pelvis. This variation in position is largely due to variations in length of the ascending colon. An abnormally movable cecum, cecum mobile, occurs when the ascending colon is provided with a mesentery. Situation of the cecum on the right side of or posterior to the ascending colon is the result of an incomplete or arrested descent of the cecum. In these cases the appendix is almost always fixed at a higher level than is the cecum.

Ascending Colon.—The anterior and both lateral walls of the ascending colon are covered with peritoneum, but the posterior wall lies directly on the fascia over the psoas and quadratus lumborum muscles. There is normally no mesentery. The ascending colon, conforming to the posterior abdominal wall, forms a posterior curve which is best appreciated when the colon is viewed from the side (Fig. 56). When this curve is marked, as is not infrequently the case, a considerable part of the ascending colon may be concealed in the usual anterior or posterior roentgenographic projection.

Congenital veils are very commonly present in relation to the ascending colon. Usually these are broad, thin veils which deform slightly the contour of the colon without producing any stenosis and without limiting seriously the expansibility of this part of the colon. In some instances the veil is not limited to the ascending colon, but extends to the distal loop of the hepatic flexure and the proximal part of the transverse colon, holding the ascending colon and the proximal part of the transverse colon in close apposition and producing a sharp angulation of the colon at the hepatic flexure. Very rarely, instead of a thin, diffuse veil, there will be a narrow, localized, dense band which constricts the colon and causes a definite stasis proximal to the point of constriction. These may be acquired during life due to an inflammatory process, but are more commonly congenital anomalies, probably abnormal fixations of the omentum.

Transverse Colon.—The transverse colon, normally slung like a hammock between the hepatic and splenic flexures and attached to the posterior abdominal wall by the long transverse mesocolon, is the most freely movable part of the colon. The transverse colon varies markedly in length in different individuals, and in the same individual shows a marked difference in length at various stages of filling and contraction. In this part of the colon one may see most clearly the shortening of the colon which occurs when it contracts

over a long area to expel its contents (Figs. 58 and 59). The lowest level of the festoon of the transverse colon depends upon several factors: (1) the general build of the individual; (2) the length of the transverse colon; (3) the height of fixation of the hepatic and splenic flexures, and (4) the degree of filling of the transverse colon. All of these factors must be taken into consideration in determining the possible clinical importance of a low transverse colon. One must always bear in mind that the position of certain abdominal organs will depend upon the size, movability, and solidity of the organ itself, and upon the size and shape of the available space which it may occupy. An abnormally short transverse colon will press upon the posterior surface of the stomach and produce a cascade type of stomach.

Hepatic and Splenic Flexures.—We know from the roentgenographic studies of the colon of many individuals by means of the barium meal and the barium enema, and with the colon filled with varying amounts of an opaque suspension, that the degree of fixation and the height of fixation of these flexures is markedly varied, and that the flexures may change position in the same individual. The position of the hepatic flexure varies the least both in different individuals and in the same individual. Usually it bears a fairly constant relation to the lower surface of the liver, and is displaced inferiorly by enlargement of the liver, both anteriorly and inferiorly by a growth developing in the tissues posterior to it, and by any considerable enlargement of the right kidney.

The splenic flexure generally lies at a higher level than the hepatic flexure, but is as a rule more freely movable, and in a few cases lies at a lower level than the hepatic flexure. Only rarely is the splenic flexure as high as the diaphragm, and in these few cases there is an abnormally firm fixation of the splenic flexure to the under surface of the diaphragm.

Descending and Sigmoid Colon.—The descending colon is normally not provided with a mesentery and is quite firmly fixed in position. The descending colon follows a fairly straight course and the only common variation is a short anterior looping which is fairly frequently present just above the crest of the left ilium.

In the left iliac fossa about two inches below the level of the crest of the ilium the colon is very frequently covered by a peritoneal band which limits the expansibility of this part of the colon (Fig. 65). This occurs just above the point where the mesentery of the sigmoid colon begins, and is frequently used as a landmark to establish the division between the descending and sigmoid colon. An excellent drawing of an anatomical specimen showing this condition from Piersol's 1911 edition of Quain's "Human Anatomy," is reproduced here (Fig. 64).

The form of the sigmoid colon varies more than that of any other part of the colon. Its simplest form is a short loop. Depending upon its length and the length of its mesentery, it assumes many bizarre forms and occupies various positions. It may lie coiled entirely within the lesser pelvis, and yet we have seen a long loop of the sigmoid reach to as high a level as the splenic flexure.

Rectum.—The colon becomes fixed in position again in the posterior part of the pelvis at the level of the third lumbar vertebra, and continues inferiorly as the rectum. The rectum is characterized by the presence of three permanent transverse folds, the valves of Houston. One of these is situated on the right side, and the other two are on the left side, one above and one below the right fold. These folds, which are frequently viewed on edge in the roentgenograms, serve to demonstrate the second fundamental finding. At the floor of the pelvis the rectum terminates in its second portion, the anus, which is occasionally observed roentgenographically in the contracted state after evacuation of the barium meal or enema.

The wall of the colon, like the wall of the other parts of the digestive tract, is composed of five coats, namely, mucosa, muscularis mucosæ, submucosa, muscularis propria, and the serosa. This structure is illustrated in Figure 60, which shows one-half of a specimen of the colon cut longitudinally. This specimen shows also the detailed structure of the semilunar folds which protrude into the lumen of the colon, dividing the lumen into sacculations or haustra. As this figure shows, these folds are composed of a reduplication of mucosa, muscularis mucosæ, and a core of submucosa. In only one region (Fig. 60-*A*) is there any drawing in of the muscularis propria. It is our conviction, from roentgenographic studies of the colon and from a study of specimens of the colon, that the semilunar folds which form the haustrations of the colon are actively formed by contraction of the muscularis mucosæ, and are not due to contraction of the muscularis propria, and also are not a passive formation due to contraction of the longitudinal bands.

Areas of Tonic Contraction of the Colon.—Anatomical and physiological sphincteric tracts have been described in several areas of the colon which have an important bearing in relation to roentgenographic findings. These are not constant formations which can be found routinely in every case, and usually do not have easily demonstrated anatomical characteristics. According to Hirsch they may be recognized in fresh autopsy specimens and on surgical exposure during life as areas of contractions which have a lighter, pinker color than the adjacent areas of the colon. We have observed a similar appearance of the fan-shaped muscle of the pyloric canal. Interesting from a functional standpoint are the experimental findings of Cannon which show that any area of tonic contraction in the colon, whether occurring spontaneously or produced by local stimulation, may act as the origin of waves of contraction which pass distally or proximally from the area of tonic contraction. Spontaneously formed areas of tonic contraction are probably the "pacemakers" of Alvarez.

Hirsch (1924) called attention to the presence of a cecocolic sphincteric tract in the ascending colon about one to two and one-half inches above the ileocecal valve, which he was able to demonstrate roentgenographically and in anatomical specimens. He attributes to this tract the physiological function of retarding the outflow of the cecal contents into the ascending colon until such time as cecal digestion and absorption be complete. He claims that this function is due both to the sphincteric action of this tract and to anti-peristaltic

contractions which originate in the tonically contracted muscle of this tract. A second physiological function is the origin in this tract of waves of contraction which pass distally and convey the fecal contents into the more distal parts of the colon. In our own material we have occasionally observed an area of tonic contraction in this part of the ascending colon (Fig. 62). In one case in particular (Fig. 63) it was a persistent finding and the site of origin of repeated, extensive contractions of the more distal part of the colon, and was, apparently, the functional source of a marked diarrhea which occurred with any worry or excitation. The findings obtained from studies of the colon by means of the barium enema also show that in many cases the contraction of the colon which evacuates the enema begins at this point (Fig. 62). This is most commonly observed and is actually a source of difficulty when one attempts to keep the colon filled with a barium enema before the irritative effects of castor oil have disappeared. From our own findings we are unable to find any positive evidence of a sphincteric action. When the barium meal passes from the small intestine into the colon, it gradually fills the ascending colon in continuity, and is more likely to be carried over into the transverse colon at an early period than to linger in the cecum and proximal part of the ascending colon.

Cannon and other observers have described a normally recurring area of tonic contraction which arises in the proximal part of the transverse colon. In animal experiments, peristaltic waves of contraction which pass both proximally and distally have been observed as originating in this area of tonic contraction. Roentgenologically one quite frequently observes long waves of contraction which originate in the proximal part of the transverse colon and produce a mass movement of the fecal contents which has been described by Case and others. Contractions arising in this region are more frequently observed in the forward passage of the barium meal than in the evacuation of the barium enema. An area of tonic contraction in the proximal part of the transverse colon is illustrated in Figure 61.

A less commonly observed sphincteric tract, which is apparently also a localized tonic contraction, is the rectosigmoid apparatus at the junction of the sigmoid colon and rectum.

(To be continued)

Editor's Comment.—It may not be amiss to call attention to the unusual excellence of the illustrations which constitute so valuable a part of this series of papers by The Cole Collaborators—Lewis Gregory Cole, M.D., Robert Earl Pound, M.D., Russell Wright Morse, M.D., Courtenay I. Headland, M.D., William Gregory Cole, M.D., and Ames W. Naslund, M.D. These illustrations have been prepared under the close supervision of Dr. Lewis Gregory Cole, for whom nothing short of the highest attainable degree of natural similitude has been achieved.

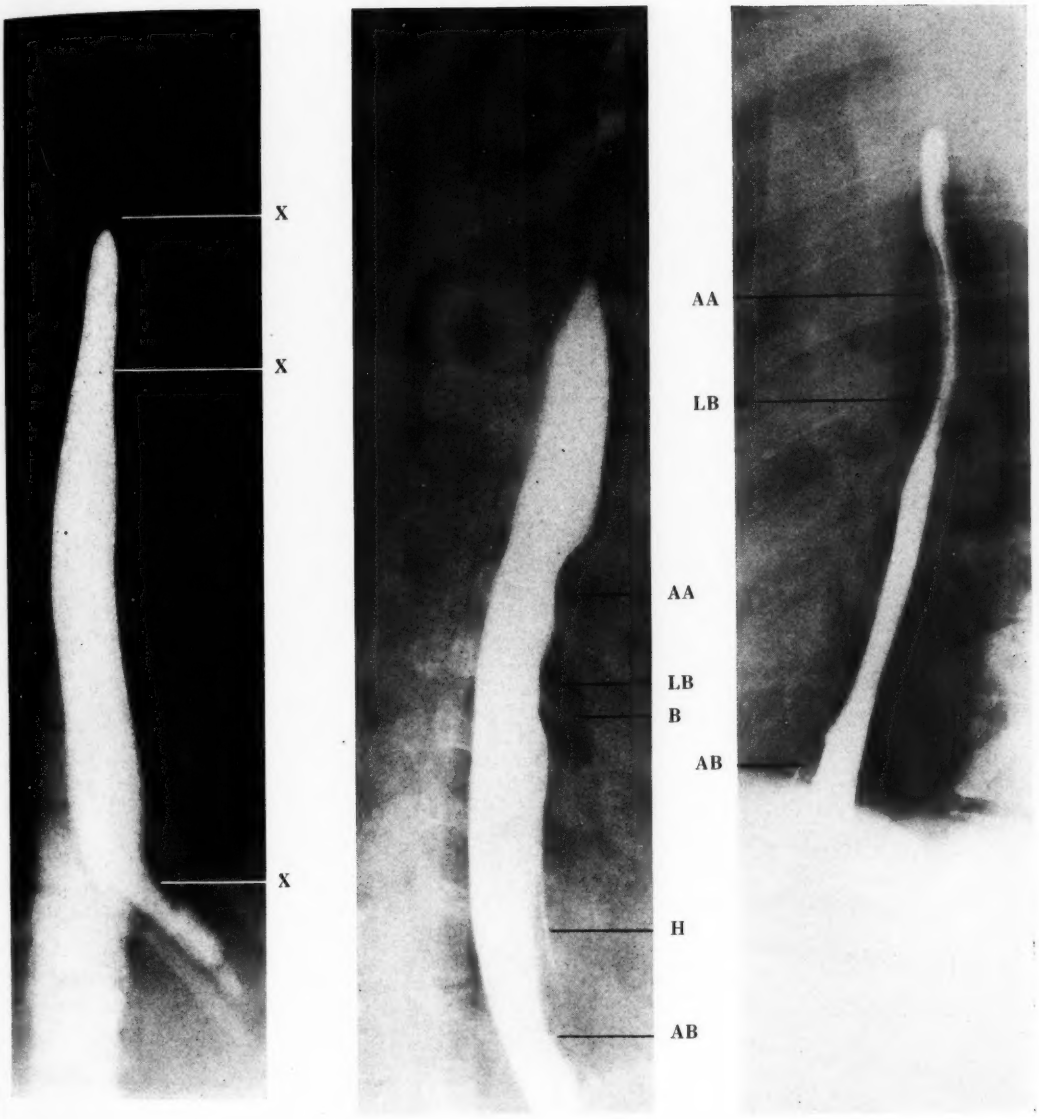

Fig. 20. Roentgenograms made in the anteroposterior (*A*), right oblique (*B*), and left oblique (*C*) projections of the esophagus. The use of these three projections enables one to observe the several profiles of the esophagus exactly as one would step around a tree to observe its curved surface.

AA—Indentation of the arch of the aorta: *LB*—Indentation of the left main bronchus (*B*): *H*—Conformation to the contour of the heart: *X*—Anatomical points of narrowing: *AB*—Air bubble.

A and *B* were made with our routine gas tube technic, the plate-target distance being 29 inches and the length of exposure 1/20 of a second. *C* was made in 1/40 of a second, using a gas tube, 500 milliamperes, and a target-plate distance of 42 inches.

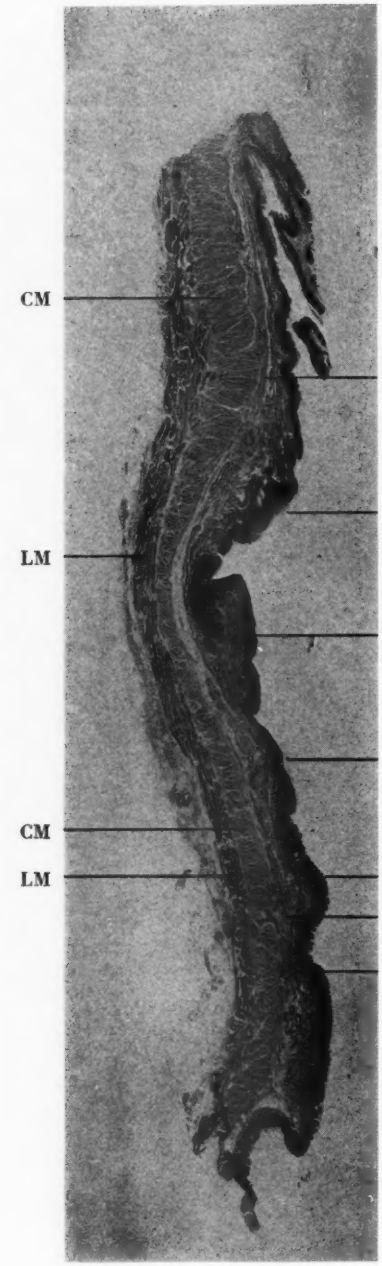

Fig. 21. Photomicrograph of a longitudinal section through the lower part of the esophagus and the upper part of the lesser curvature of the stomach. At the junction of the esophagus and stomach (*X*), the stained section shows the marked difference in appearance between the stratified squamous epithelium of the esophagus and the tubular glands of the gastric mucosa. There is no break in the structure of the other coats of the esophagus and stomach. At *U* there is an ulceration of the esophagus involving the mucosa and the submucosa. *M*—Mucosa: *MM*—Muscularis mucosæ: *S*—Submucosa: *CM*—Circular layer of the muscularis propria: *LM*—Longitudinal layer of the muscularis propria.

Fig. 22

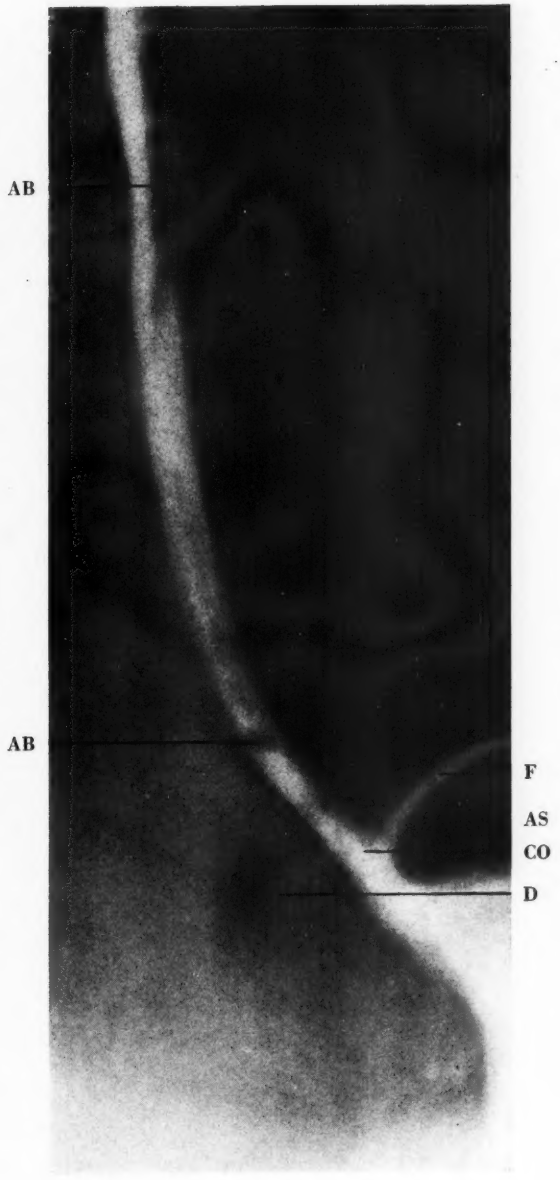

Fig. 23

Figs. 22 and 23 are roentgenograms which illustrate the appearance of air bubbles (*AB*) in the barium-filled esophagus. The air is swallowed and is carried down the esophagus ahead of a bolus of barium. The air either passes into the stomach or, after reaching the lower part of the esophagus, passes upward between the wall of the esophagus and the barium. As shown in these roentgenograms the appearance simulates very closely the displacement of the barium by an organic lesion protruding into the lumen of the esophagus. *AS*—Air bubble in fornix of stomach: *CO*—Cardiac orifice: *D*—Crux of left diaphragm: *F*—Barium adherent to superior wall of fornix: *AA*—Indentation of the arch of the aorta.

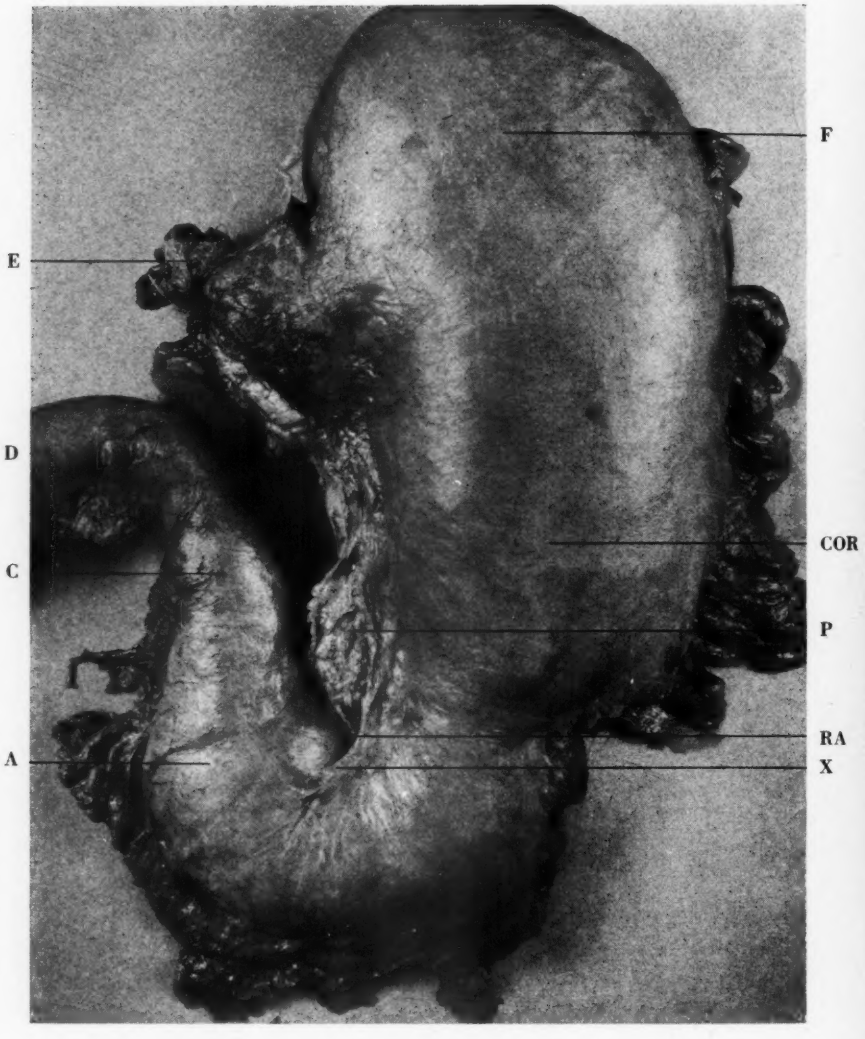

Fig. 24. Photograph of the outside of the stomach. The lumen of the specimen is filled with wax. *E*—Esophagus: *F*—Fornix: *COR*—Corpus: *A*—Antrum: *C*—Cap: *D*—Duodenum: *P*—Peritoneal covering over the intraperitoneal gastric triangle: *RA*—Recedent angle or incisura angularis on the lesser curvature of the stomach: *X*—Reflection of the gastrohepatic ligament on the anterior surface of the stomach which simulates in appearance a "wind-blown bob".

Fig. 25. Drawing of the outside of the stomach. *E*—Esophagus: *F*—Fornix: *COR*—Corpus: *A*—Antrum: *C*—Cap: *D*—Duodenum: *GCL*—Gastro-colic ligament: *GHL*—Gastro-hepatic ligament: *P*—Peritoneal covering over the intraperitoneal gastric triangle: *RA*—Recedent angle or incisura angularis on the lesser curvature of the stomach: *X*—Reflection of the gastro-hepatic ligament on the anterior surface of the stomach which simulates in appearance a "wind-blown bob".

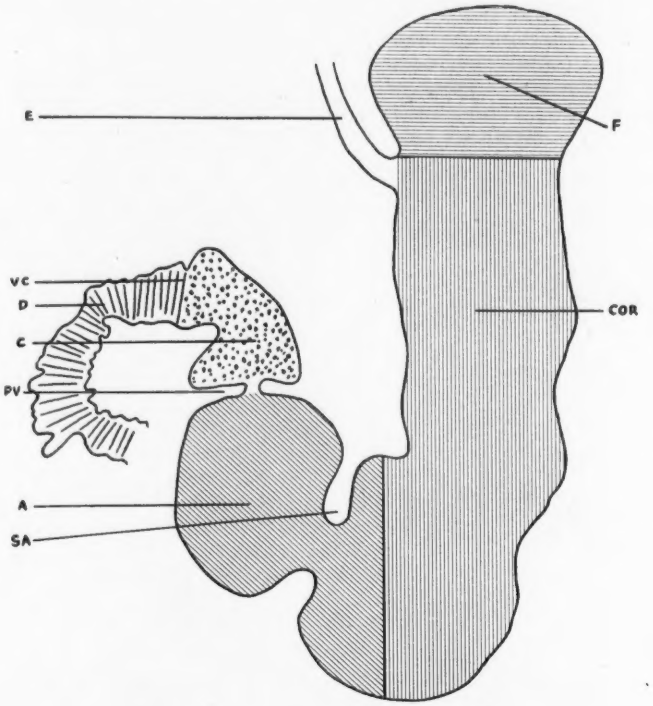

Fig. 26

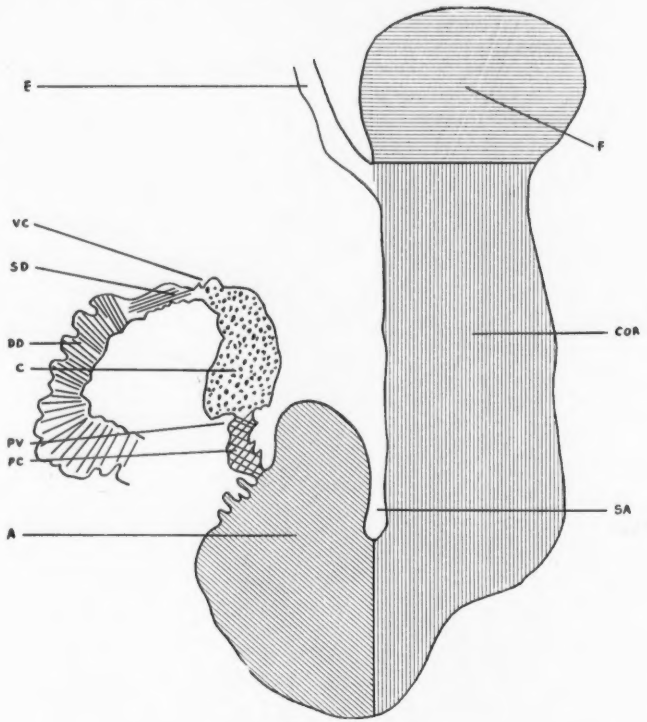

Fig. 27

Figs. 26 and 27 are tracings of roentgenograms of the same individual. The chambers of the stomach are mapped out by cross-lining, cross-hatching, and dots. The figures illustrate the change in outline of the chambers of the stomach in two stages of the gastric cycle. Fig. 26 shows systole of the stomach. Fig. 27 shows diastole of the stomach. *E*—Esophagus: *F*—Fornix: *COR*—Corpus: *SA*—Sulcus angularis: *A*—Antrum: *PC*—Pyloric canal: *PV*—Pyloric valve: *C*—Cap: *VC*—The first of the valvulæ conniventes: *DD*—Descending duodenum: *D*—Junction of superior and descending duodenum.

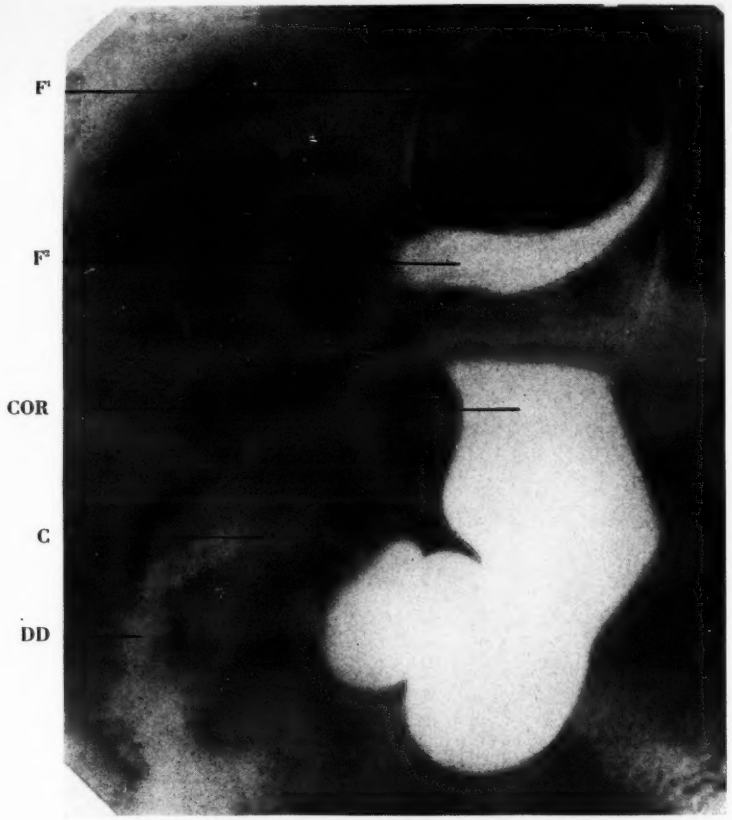

Fig. 28. Postero-anterior projection, erect posture.

Fig. 29. Right oblique projection, erect posture.

Figs. 28 and 29 are roentgenograms of the same individual which show the characteristic findings produced by a well-developed corporic shelf. The indentation produced by the shelf is best viewed in the oblique projection (Fig. 29, *CS*). Part of the fornix is at a lower level than the upper division of the corpus and part of the barium meal remains in this lower division of the fornix, as indicated at F^2. In the postero-anterior projection the corporic shelf can not be seen, but the characteristic double shadow of barium meal and gas is shown distinctly. One must bear in mind that a similar finding is present in the cascade type of stomach, due to suspension of the stomach over a high transverse colon. F^1—Gas bubble in upper part of fornix: F^2—Barium in the lower part of the fornix: *CS*—Corporic shelf: *COR*—Corpus: *C*—Cap: *DD*—Descending duodenum: *B*—Margin of the shadow of the breast.

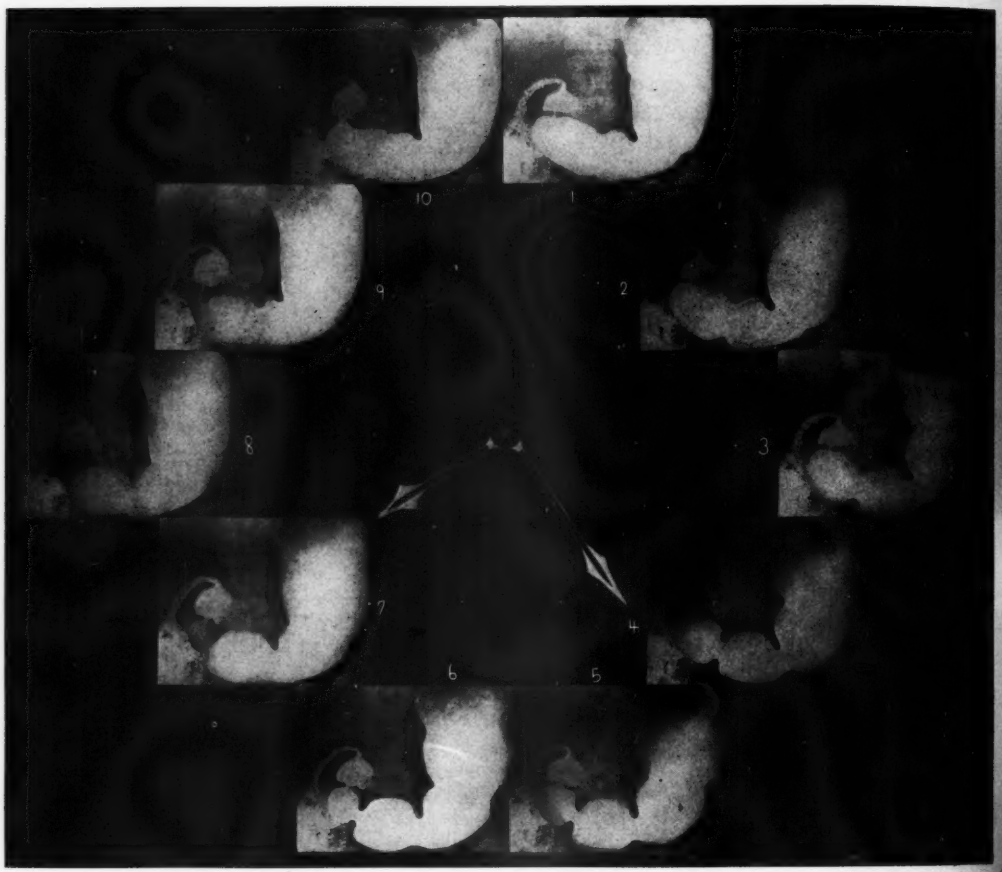

Fig. 30. Roentgenograms illustrating ten stages of a single cycle of the gastric motor phenomenon. Peristalsis is of the four-cycle type.

No. 1 is the first stage of systole: Nos. 2, 3, 4, 5, and 6 are advancing stages of systole: No. 7 is the beginning of diastole: Nos. 8 and 9 are relaxing stages of diastole: No. 10 is complete diastole: Nos. 7, 8 and 9 show concentric contraction of the fan-shaped muscle of the pyloric canal, and No. 10 shows the sudden relaxation of the fan-shaped muscle.

Nos. 1 to 10 show progressive filling of the cap during the gastric cycle, and Nos. 7, 8, and 9 show the altered shape of the base of the cap due to the contraction of the fan-shaped muscle.

For progression of the peristaltic wave one should note both the greater and lesser curvatures.

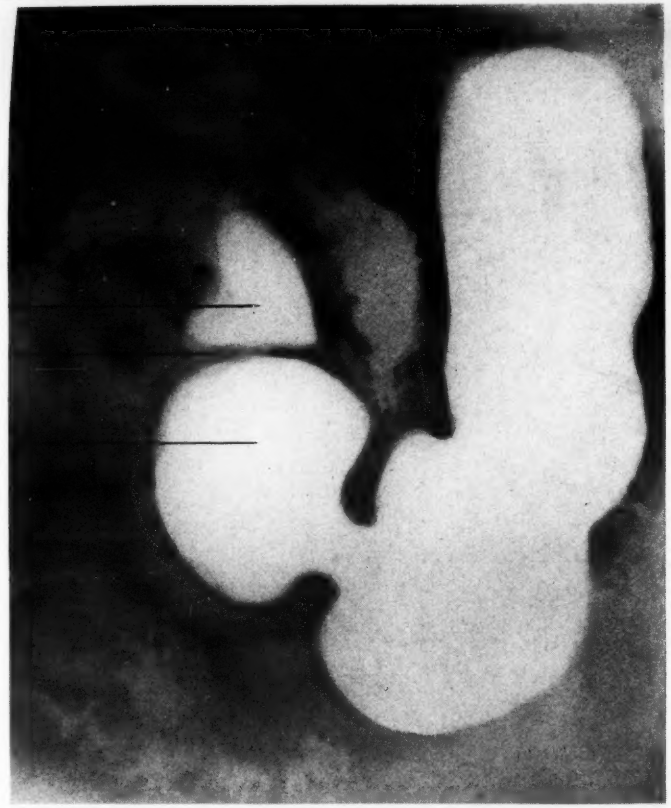

Fig. 31

Fig. 32

Figs. 31 and 32 are roentgenograms which show two stages of the gastro cycle. In Fig. 31 the pyloric canal division of the antrum (*A*) is fully distended and this is termed "diastole of the pyloric canal." The antrum is fully distended, more or less egg-shaped, and its outline is clear-cut and smooth. The cap (*C*) is separated from the antrum by the pyloric valve (*PV*). The base of the cap is wide and corresponds in contour with the adjacent portions of the antrum.

In Fig. 32 the pyloric canal (*PC*) is in the complete stage of contraction and, therefore, termed "complete systole of the pyloric canal." The barium content of the stomach within this region is evidenced by only a small accumulation of barium between the mucosal folds, which are squeezed together by the strong contraction of the circular fan-shaped muscle. The cap is very narrow at its base, corresponding in contour with the contracted pyloric canal. Compare the appearance of the lumen of the cap as observed here with the outside of the cap as shown in Fig. 36, where the pyloric canal is contracted by rigor mortis of the fan-shaped muscle. Bear in mind that systole and diastole of the pyloric canal is not the same as systole and diastole of the stomach.

Fig. 33. Photograph of the posterior half of a post mortem specimen which includes the lower esophagus, the stomach, the cap, and the superior duodenum. The partially distended state of the specimen was maintained by filling the specimen with a low melting point paraffin before it was preserved in formalin.

E—Esophagus: *CO*—Cardiac orifice: *F*—Fornix: *CR*—Crinkled rugæ in the distal part of the corpus: *PA*—Proximal part of the antrum: *PC*—Contracted pyloric canal: *FSM*—Fan-shaped muscle of the pyloric canal: *PV*—Pyloric valve: *C*—Cap: *D*—Superior duodenum: *MA*—Membrana angularis of Forssell. This is a relatively thin area of the muscularis propria on the lesser curvature side of the antrum.

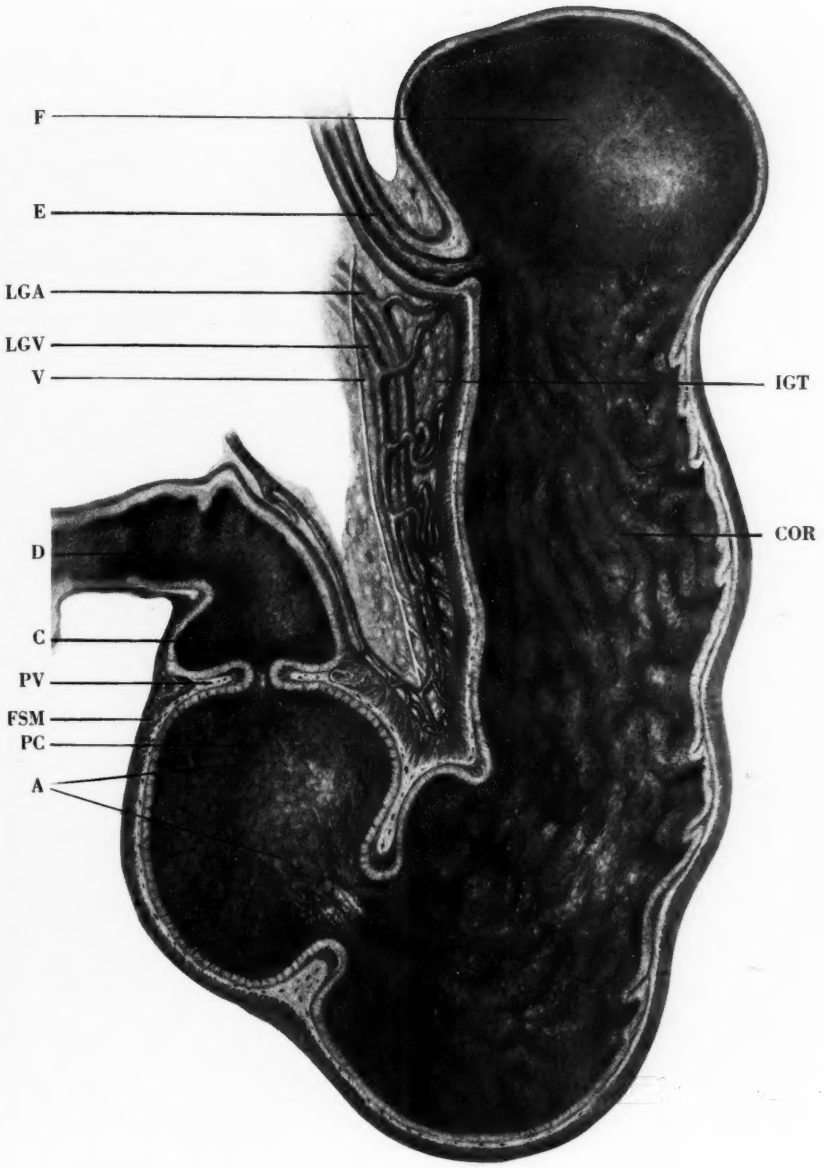

Fig. 34. Drawing of inside of the stomach during diastole of the pyloric canal. *E*—Esophagus: *F*—Fornix: *LGA*—Left gastric artery: *LGV*—Left gastric vein: *V*—Vagus nerve: *IGT*—Fat in the intraperitoneal gastric triangle: *COR*.—Corpus of stomach, showing the mucosal folds or rugæ: *A*—Antrum: *PC*—Pyloric canal, relaxed: *FSM*—Fan-shaped muscle of the pyloric canal: *PV*—Pyloric valve: *C*—Cap: *D*—Duodenum.

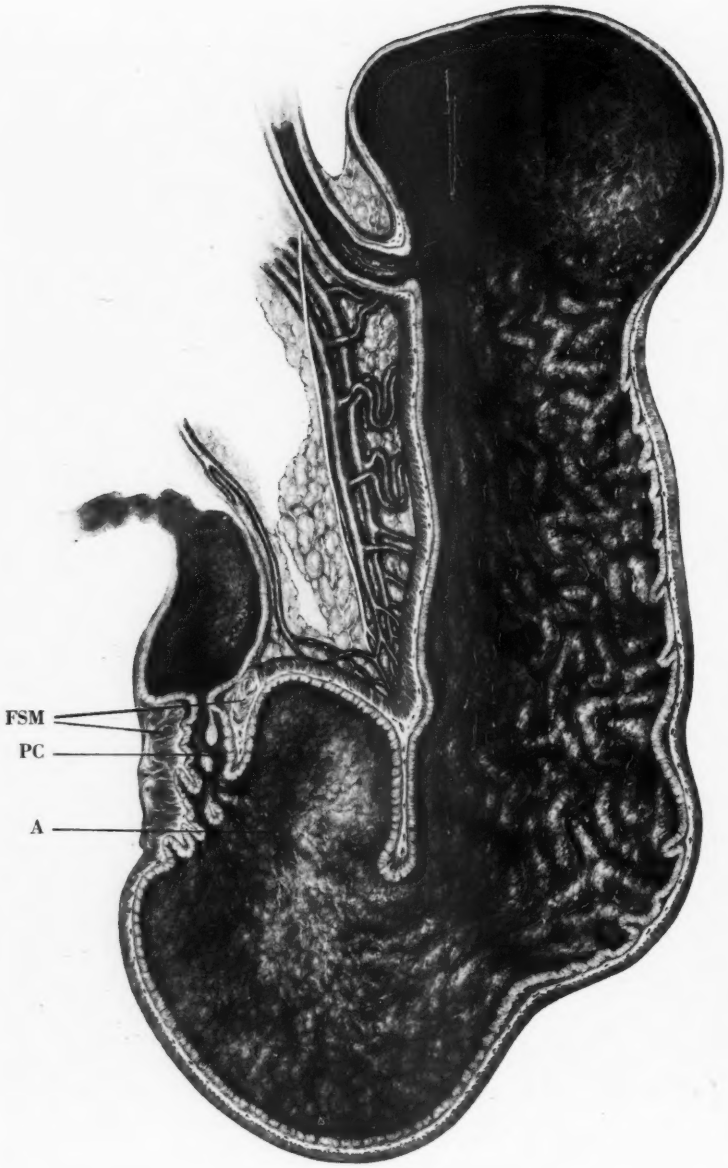

Fig. 35. Drawing of the inside of the stomach during systole of the pyloric canal. *A*—Proximal division of the antrum: *PC*—Pyloric canal, contracted. The pyloric canal is the distal division of the antrum and is a functional formation due to contraction of the fan-shaped muscle (*FSM*).

Fig. 36. Photograph of the outside of the cap. The lumen of the specimen is filled with wax. *C*—Cap: *PC*—Pyloric canal: *X*—Junction of the cap and the pyloric canal marked by the distal edge of the contracted fan-shaped muscle of the pyloric canal: *D*—Superior duodenum: *Y*—A tear (artefact) in the peritoneal covering of the cap.

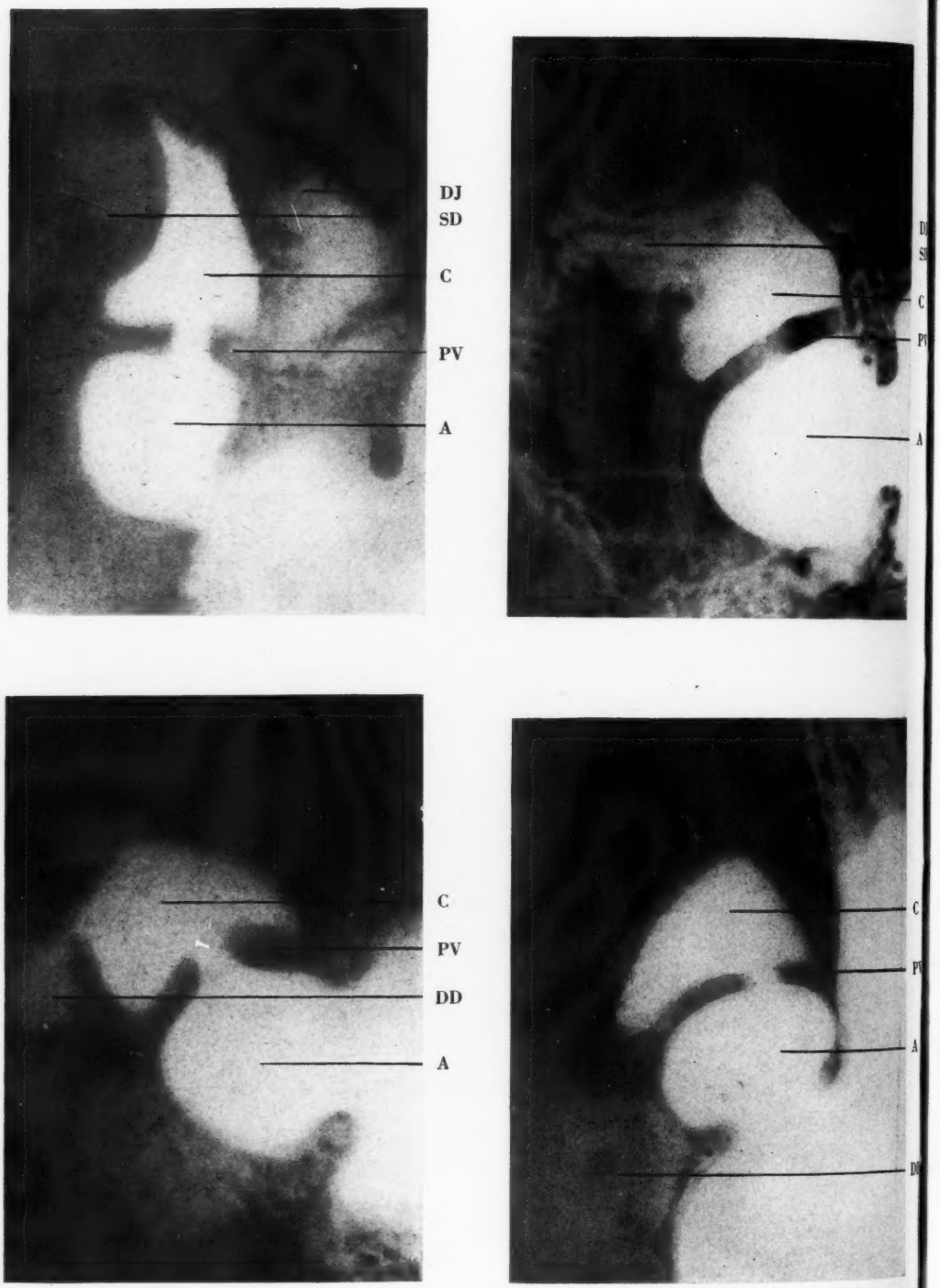

Fig. 37. Roentgenograms showing four normal caps. *C*—Cap: *PV*—Pyloric valve: *A*—Antrum: *DJ*—Duodenojejunal flexure: *SD*—Superior duodenum: *DD*—Descending duodenum.

Fig. 38. Roentgenogram made of the gastro-intestinal tract 1½ hours after ingestion of a barium meal. The barium meal fills all parts of the small intestine and shows also the stomach and the proximal part of the colon.

S—Stomach: 1—Duodenum, the first coil of the small intestine: 2—Second group of coils of the small intestine: 3—Third group of coils: 4—Fourth groups of coils: 5—Fifth group of coils: 6—Sixth group of coils: *HF*—Hepatic flexture of the colon.

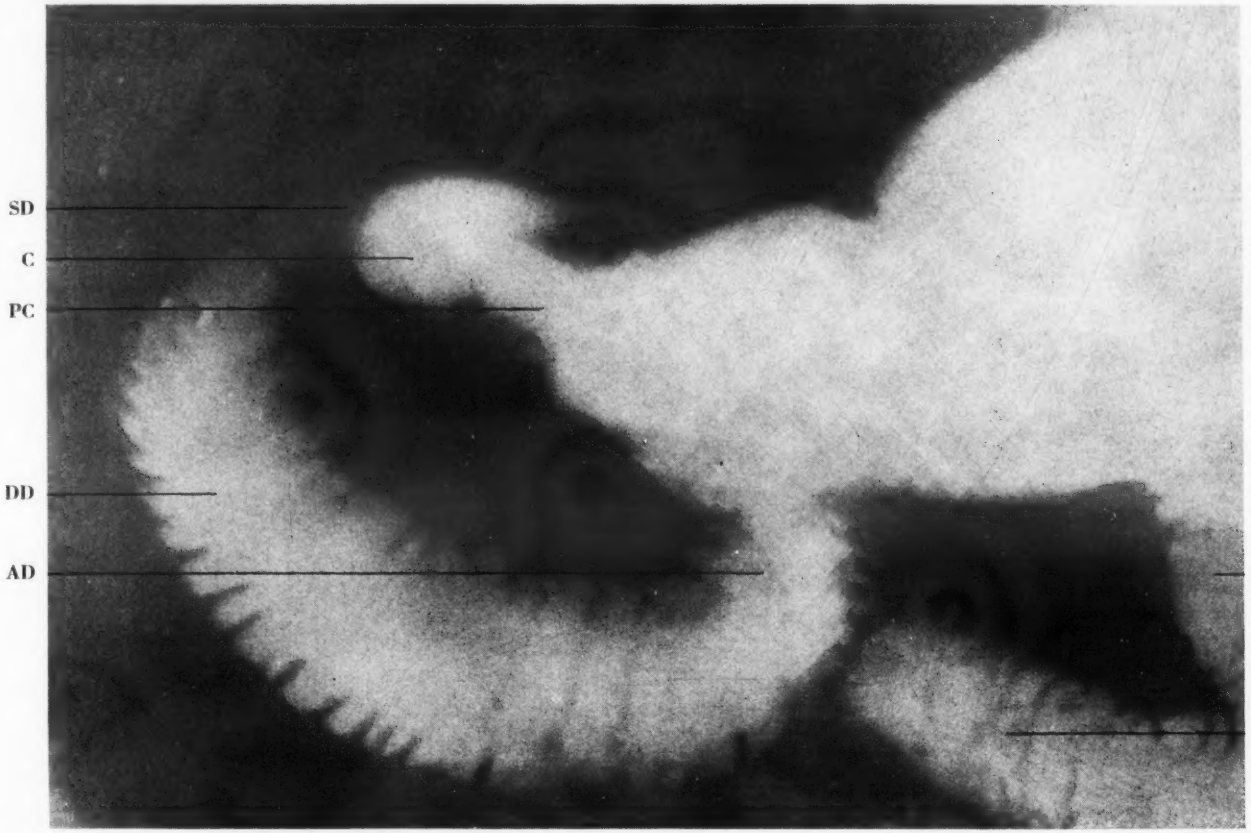

Fig. 39. The duodenum, the first of the groups of coils of the small intestine. *SD*—Superior duodenum: *DD*—Descending duodenum: *AD*—Ascending or terminal duodenum. The duodenojejunal flexure is concealed behind the stomach. *C*—Cap: *PC*—Partially contracted pyloric canal: *X*—Efferent loop of the duodenojejunal flexure, part of the second group of coils of the small intestine: *Y*—The loop of small intestine which swings back into the root of the mesentery between the second and third group of coils.

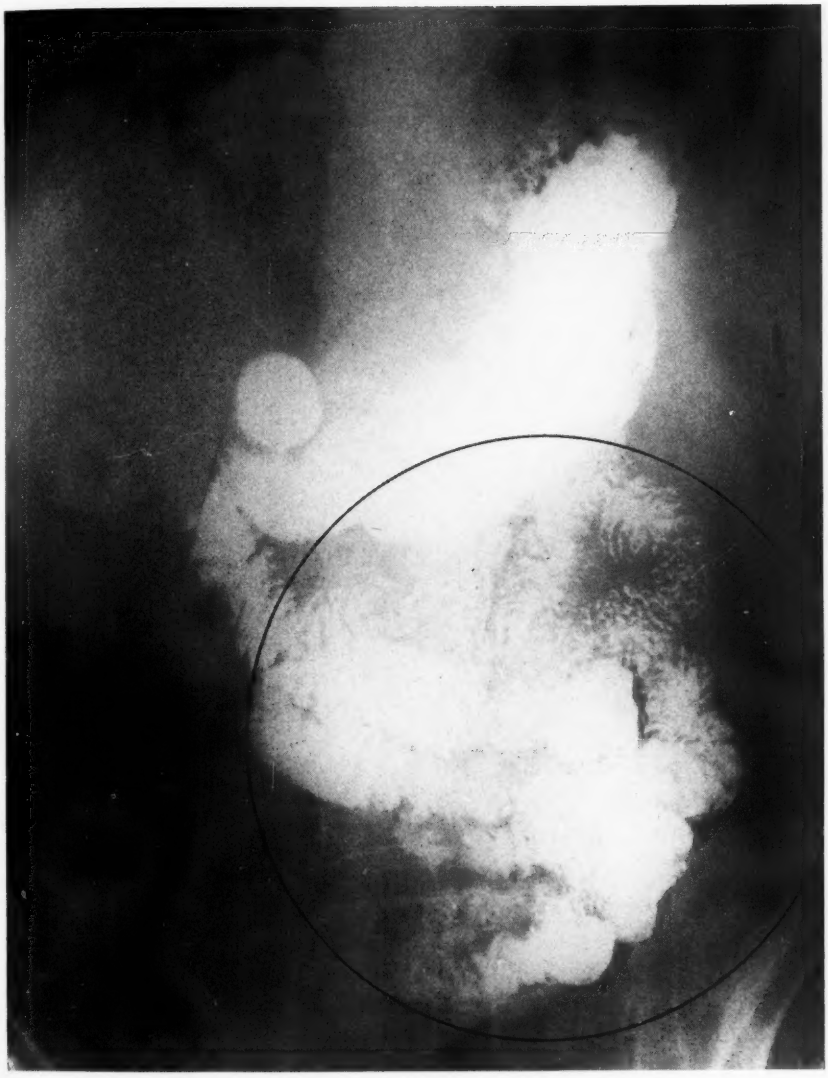

Fig. 40. This figure and the following figures are a series of roentgenograms made of the same individual at varying intervals after ingestion of a barium meal. They show the progress of the meal through the small intestine, and the characteristic grouping of the coils of the small intestine.

Patient, male, half-hour after the meal. The stomach is emptying at a moderately rapid and uniform rate of speed. The passage of the meal through the small intestine is keeping pace with the emptying of the stomach. All the loops of the small intestine are moderately distended. The circle is around the second group of coils of the small intestine.

Fig. 41. Same case shown in Figure 40, one hour after the meal. The second and third group of coils of the small intestine are filled. The circle is around the third group of coils. The loops of this part of the intestine are lower in position and confined more to one region than is usually the case. For this reason the loops overlap and conceal one another. Compare with Figure 38, in which the loops of the second and third groups of coils are discretely shown.

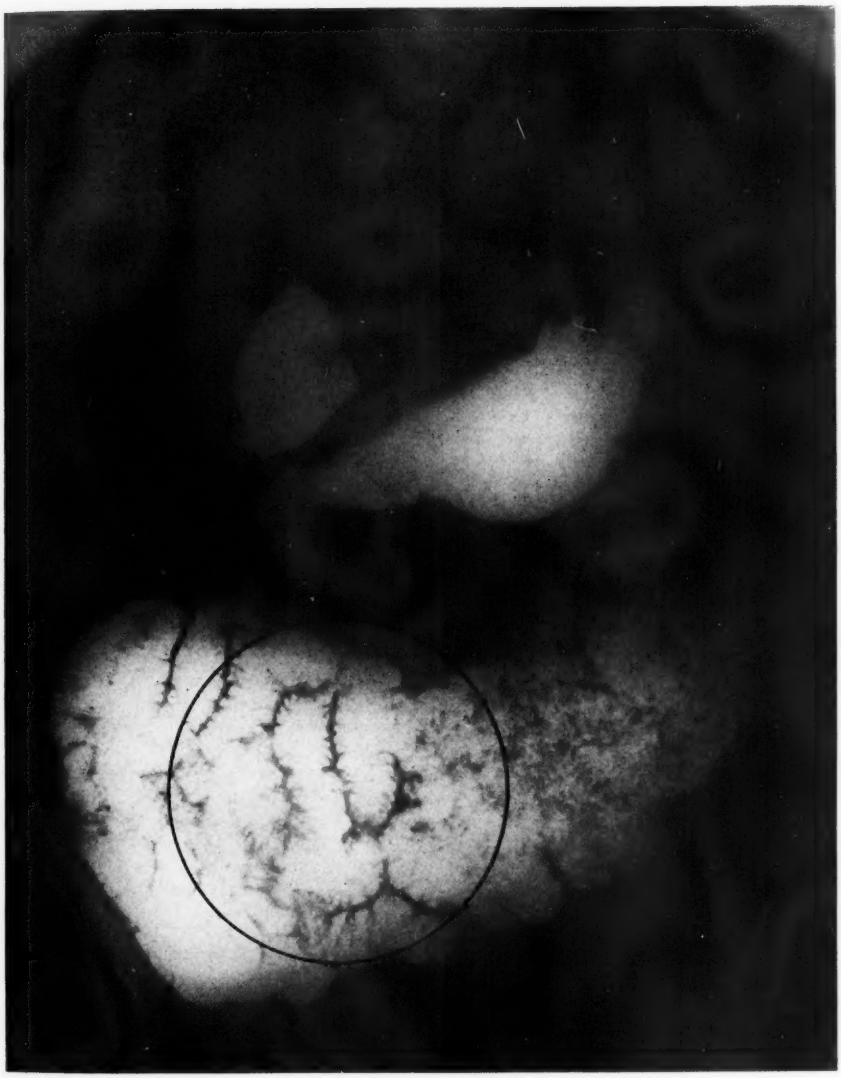

Fig. 42. Same case shown in Figures 40 and 41, 2 hrs. 10 min. after the meal. Both the fourth and fifth groups of coils of the small intestine are now filled. The circle is around the fourth group of coils. The fifth group of coils is to the right of the circle. The right iliac and lumbar regions are the usual location of the fifth group of coils.

In this figure and the following figures note the vertical arrangement of the coils within the fourth, fifth, and sixth groups of coils, and compare this with the transverse arrangement of the coils in the second and third groups.

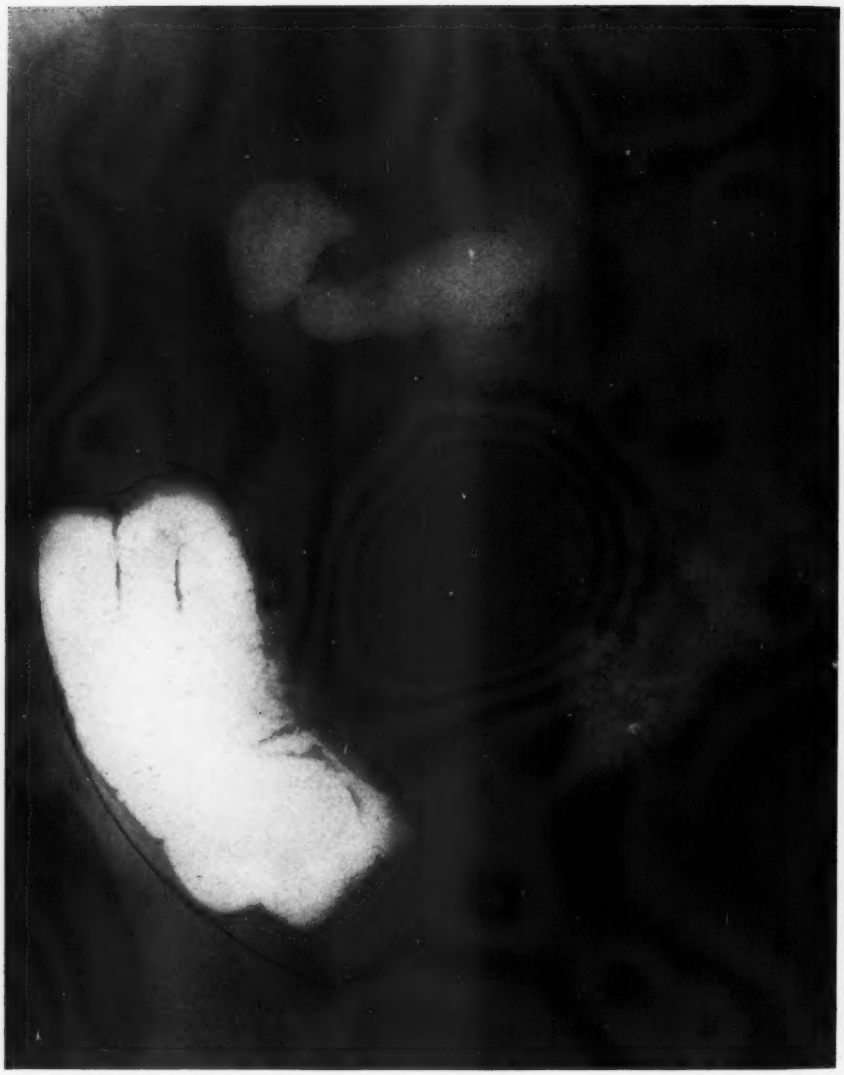

Fig. 43. Same case shown in Figures 40, 41, and 42, three hours after the ingestion of the meal. Most of the barium meal in the small intestine has collected in the fifth group of coils.

Fig. 44. Same case shown in Figures 40-43, four hours after the meal. The stomach is empty and the head of the column is in the sixth group of coils, the location of which is shown by the circle. The lower right iliac and the hypogastric regions and false pelvis are the usual location of the sixth group of coils.

Fig. 45. Same case shown in Figures 40-44, six hours after the meal. The head of the column is at the hepatic flexure. The meal remaining in the small intestine is entirely in the sixth group of coils, as indicated by the circle.

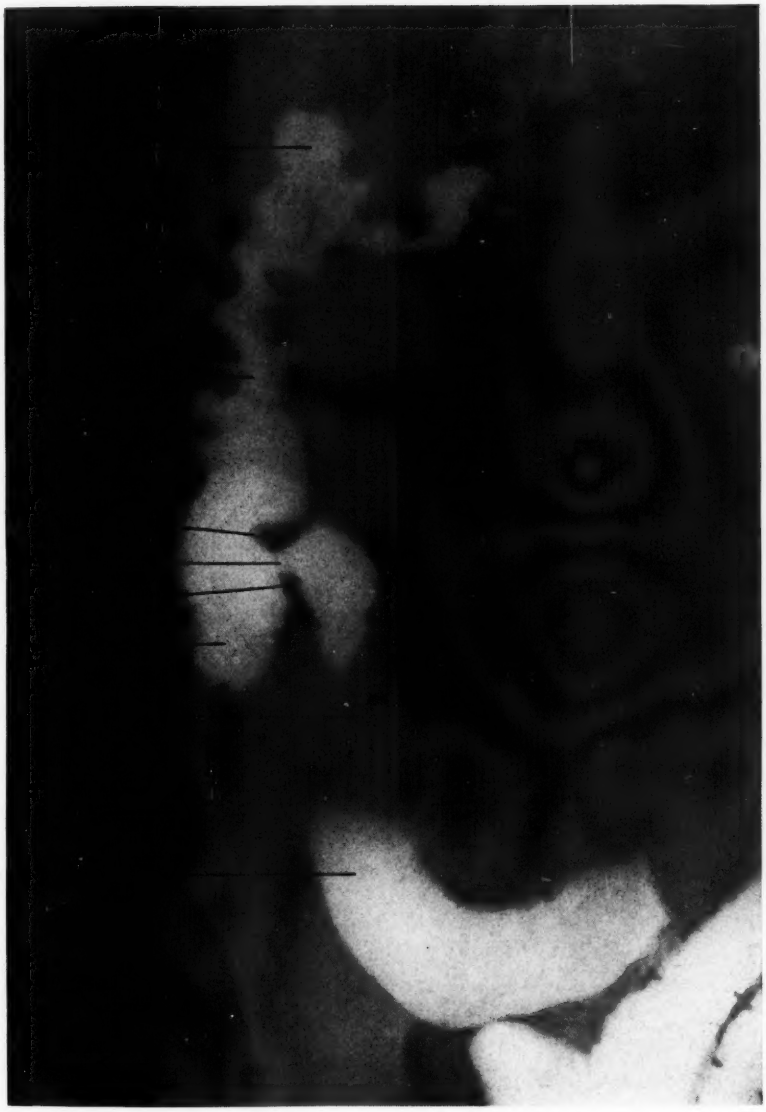

Fig. 46. The ileocecal valve as shown roentgenographically immediately after the evacuation of a barium enema. The valve is open. *L*—Lumen of the valve: *SL*—Superior lip of the valve: *IL*—Inferior lip of the valve: *TI*—Terminal ileum: *C*—Cecum: *AC*—Ascending colon: *HF*—Hepatic flexure: *CA*—Area of contraction in the terminal ileum: *X*—Dilated coil of lower ileum proximal to the area of contraction.

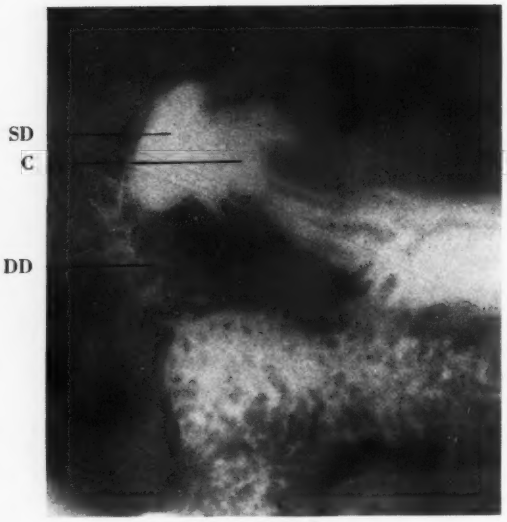

Fig. 47. Roentgenogram made in the postero-anterior direction which shows how superimposition of a long superior duodenum (*SD*) over the cap (*C*) may simulate the appearance of a deformed cap due to ulcer. *DD*—Descending duodenum.

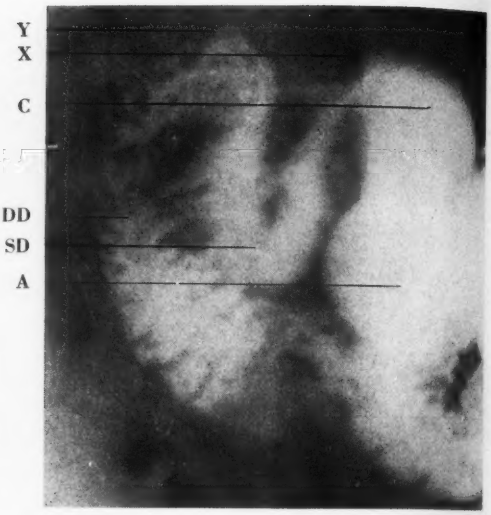

Fig. 48. Roentgenogram made in the right oblique projection which shows an unusually long superior duodenum (*SD*), which forms a loop that hangs inferiorly from the two points of suspension *X* and *Y*. *C*—Cap: *A*—Antrum of stomach: *DD*—Descending duodenum.

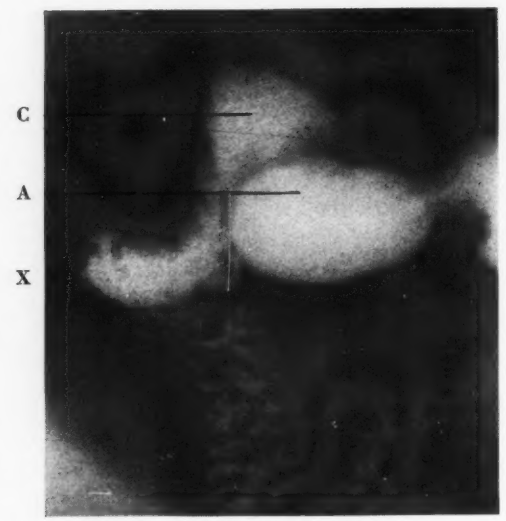

Fig. 49

Fig. 50

Figs. 49 and 50 are postero-anterior roentgenograms of the same individual, Fig. 49 being made in the prone posture and Fig. 50 in the erect posture. At *X* there is an abnormal fixation and angulation of the descending duodenum at the site of crossing of the transverse mesocolon. In the erect posture, Fig. 50, the barium remains in a short loop above this abnormal point of fixation and simulates the appearance of a diverticulum of the duodenum. *C*—Cap: *A*—Antrum of the stomach: *SD*—Superior duodenum.

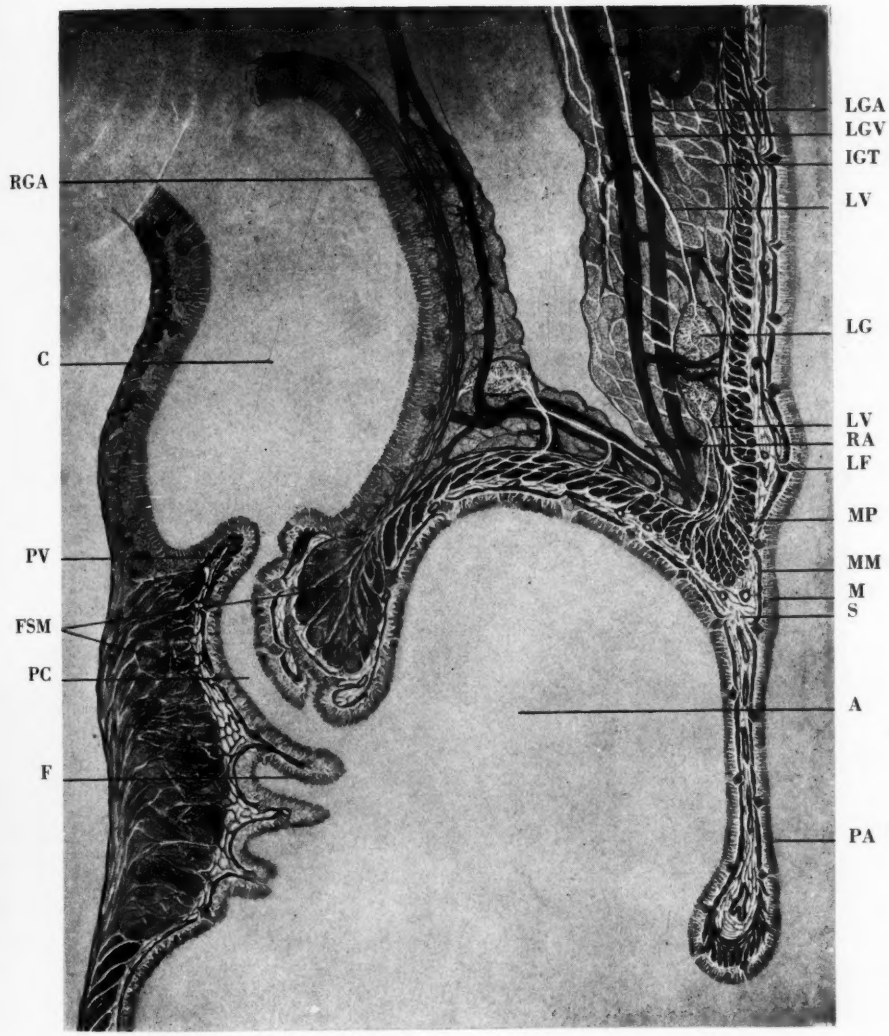

Fig. 51. Diagrammatic drawing showing the minute anatomy of the gastric wall on the lesser curvature and in the region of the pyloric canal during gastric diastole. *A*—Relaxed proximal division of the antrum: *PC*—Contracted pyloric canal, the distal division of the antrum: *C*—Cap: *PV*—Pyloric valve: *FSM*—Fan-shaped muscle of the pyloric canal: *F*—Folds of mucosa at the proximal end of the contracted pyloric canal: *PA*—Plica angularis, the mucomembranous fold which protrudes into the lumen of the stomach and produces the sulcus angularis observed in the roentgenogram: *RA*—Recedent angle or incisura angularis: *M*—Mucosa: *MM*—Muscularis mucosæ: *S*—Submucosa: *MP*—Muscularis propria: *LF*—Lymphoid follicle in the base of the mucosa: *LV*—Lymphatic vessels: *LG*—Lymphatic gland: *IGT*—Fat in the intraperitoneal gastric triangle: *LGA*—Left gastric artery: *LGV*—Left gastric vein: *RGA*—Right gastric artery

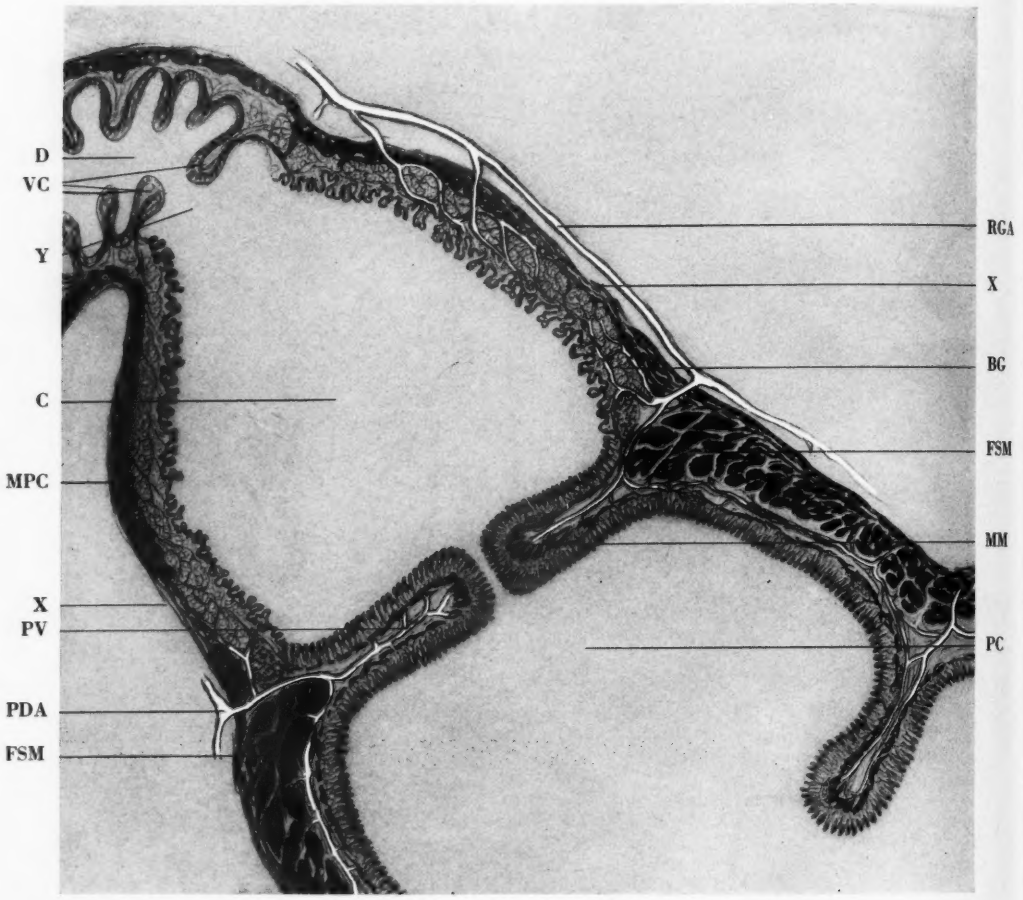

Fig. 52. Schematic drawing of the wall of the antrum and of the cap with the pyloric canal relaxed and the pyloric valve closed. *PC*—Relaxed pyloric canal or distal part of the antrum: *C*—Cap: *PV*—Pyloric valve: *D*—Duodenum: *FSM*—Fan-shaped muscle of the pyloric canal: *MM*—Contracted muscularis mucosæ in the pyloric valve. The muscularis mucosæ closes the valve and there is no pyloric sphincter of the muscularis propria of the stomach. *BG*—Brunner's glands of the cap: *MPC*—Muscularis propria of the cap. This is much thinner than the muscularis propria of the stomach. *X*—Area in the wall of the cap in which the muscularis propria is deficient. This is also the area in which the arteries terminate as end arteries. *VC*—Valvulæ conniventes, the folds characteristic of the small intestine. *Y*—Junction of the cap and the descending duodenum. *RGA*—Right gastric artery: *PDA*—Branches of the pancreatico-duodenal artery.

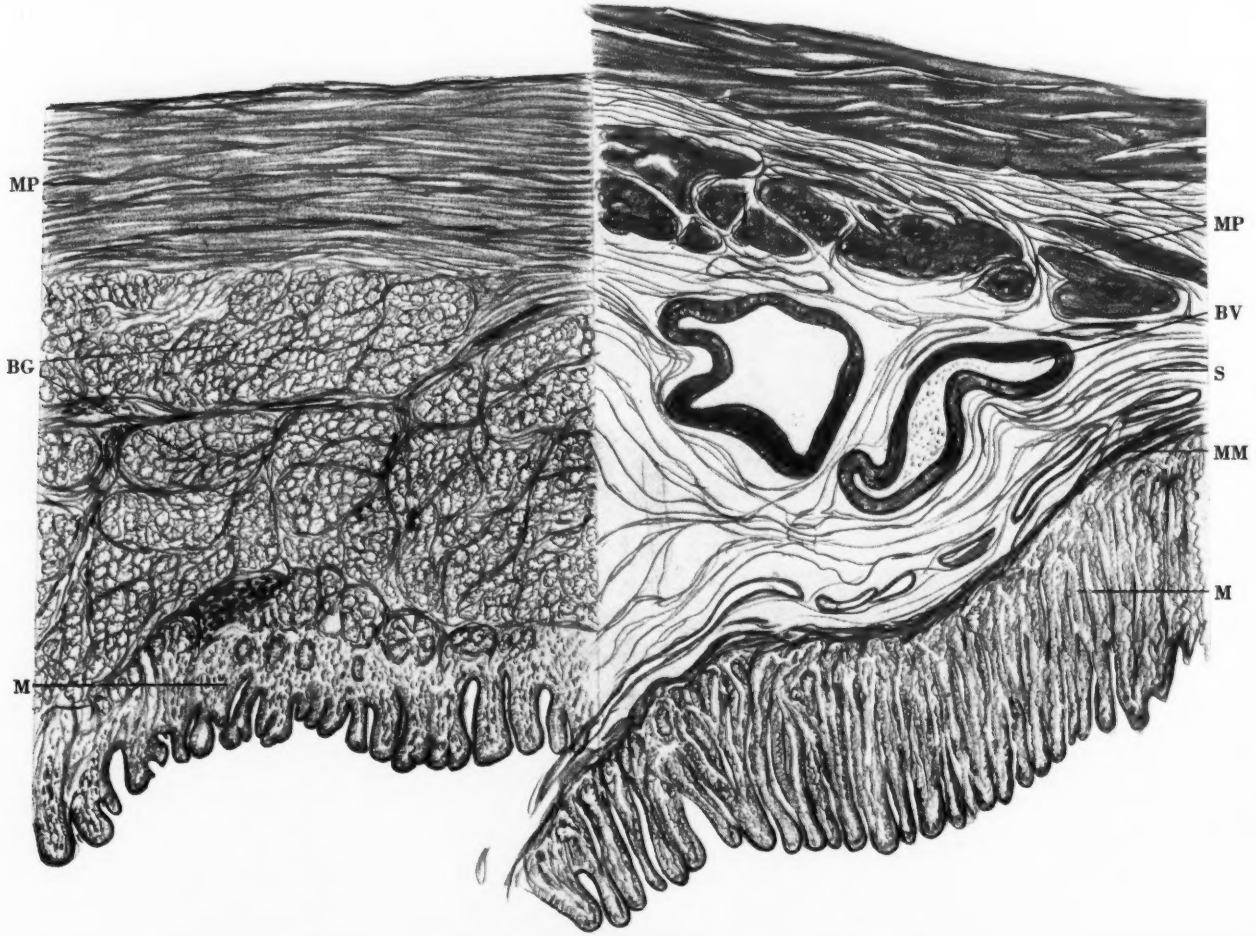

Fig. 53. Diagrammatic drawing in color, comparing the structure of the wall of the stomach and the wall of the cap. *M.*—Mucosa: S.—Submucosa: *MM.*—Muscularis mucosæ: *MP.*—Muscularis propria: *BG.*—Brunner's glands: *BV.*—Blood vessels.

Fig. 54

Fig. 55

Fig. 56

Fig. 57

Figs. 54, 55, 56, and 57, inclusive, illustrate our routine roentgenographic examination of the colon. In the postero-anterior projection (Fig. 54) there is superimposition of regions of the colon at and near both the hepatic and splenic flexures. A lesion of the colon may be concealed in either of these regions. This superimposition of the colon is obviated by making roentgenograms in the right oblique projection (Fig. 56), and in the left oblique projection (Fig. 57).

The right oblique projection (Fig. 56) shows the posterior curve of the ascending colon as it conforms to the curvature of the posterior abdominal wall, and also the sharp curve of the colon at the hepatic flexure.

Fig. 55, the roentgenogram made of the colon immediately after evacuation of the barium enema, shows the colon in the contracted state and the folds of the mucosa.

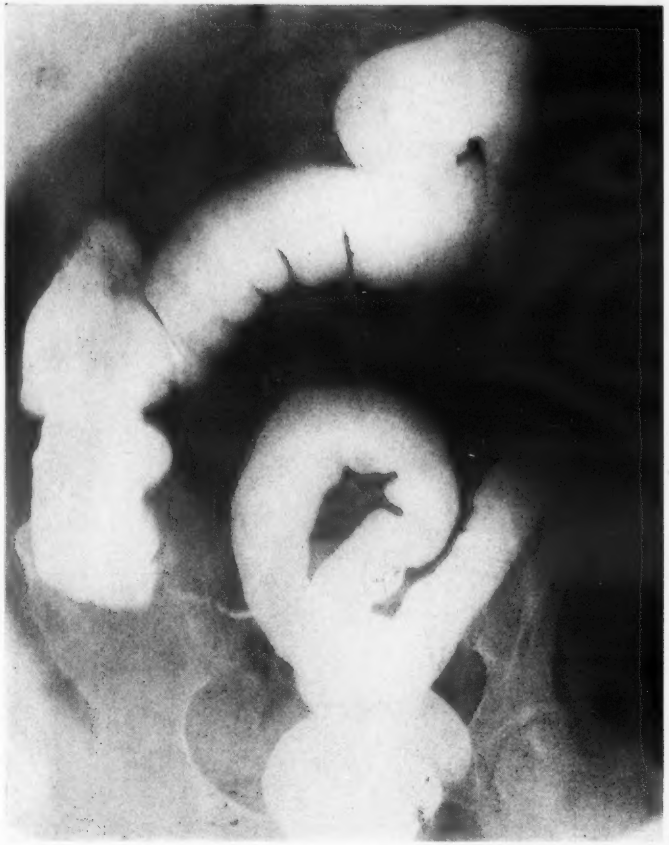

Fig. 58. Colon filled with barium enema.

Fig. 59. Colon after evacuation of the barium enema.

Figs. 58 and 59 are roentgenograms made of the same patient, Fig. 58 being made when the colon was moderately distended with the barium enema, and Fig. 59 being made after evacuation of the barium enema.

A comparison of these roentgenograms shows the marked diminution in length of the colon which takes place when a considerable length of the colon contracts. In Figure 58 the moderately distended transverse colon is markedly redundant near the splenic flexure, and yet in Figure 59 the transverse colon forms practically a straight line between the hepatic and splenic flexures. The diminution in length is also shown by the descent of the splenic flexure due to a shortening of the descending colon.

A comparison of these roentgenograms shows the marked diminution in length of the colon which takes place when a considerable length of the colon contracts. In Figure 58 the moderately distended transverse colon is markedly redundant near the splenic flexure, and yet in Figure 59 the transverse colon forms practically a straight line between the hepatic and splenic flexures. The diminution in length is also shown by the descent of the splenic flexure due to a shortening of the descending colon.

Fig. 60. Photograph of one-half of a specimen of the colon, cut longitudinally. This specimen was removed by surgical resection and was preserved immediately after removal, the specimen being hardened around a wax cast so that its natural form was retained. *M*—Mucosa: *S*—Submucosa: *MP*—Muscularis propria: *LM*—Longitudinal muscle coat of the muscularis propria: *CM*—Circular muscle coat of the muscularis propria: *AE*—Appendix epiploica.

In this specimen one can observe unusually clearly the structure of the semilunar folds (*F*) which protrude into the lumen of the colon, divide the lumen into sacculations or haustra, and give to the colon its characteristic appearance. Several of these folds are shown in this specimen and each of these folds is composed of a reduplication of the mucosa and muscularis mucosæ and a core of submucosa. The circular layer of muscle of the muscularis propria does not enter into the formation of these folds with the possible exception of the indrawn muscularis propria at *A*. It is our conviction from roentgenographic studies of the colon and from a study of specimens of the colon prepared as was this specimen, that the folds which form the haustrations of the colon are due to contraction of the muscularis mucosæ, and are not due to contraction of the muscularis propria, and are not a passive formation due to contraction of the longitudinal bands.

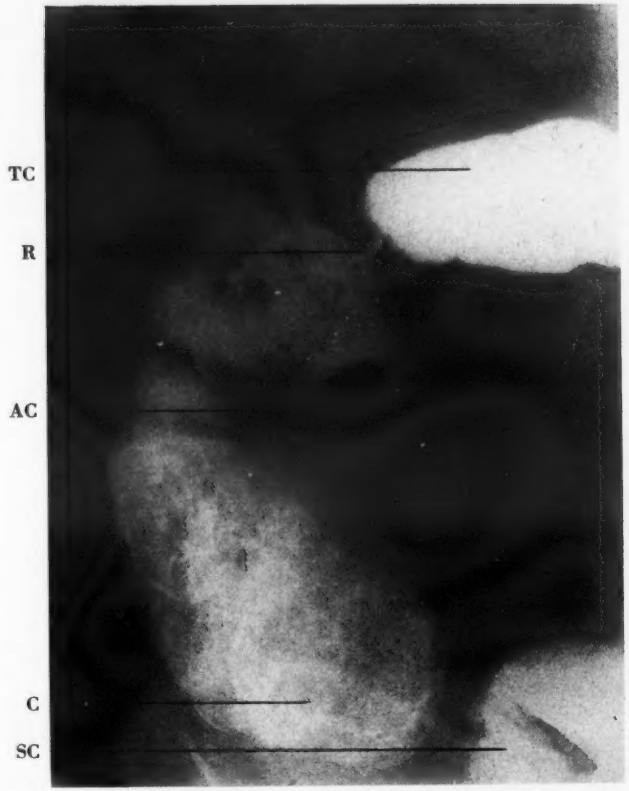

Fig. 61. Ring of tonic contraction (*R*) in the proximal part of the transverse colon (*TC*). The cecum (*C*) and the ascending colon (*AC*) are filled with a mixture of the barium enema and fecal material, and the density of the shadow is considerably less than that of the barium enema in the transverse colon and the sigmoid colon (*SC*).

Fig. 62. Roentgenogram made after evacuation of a barium enema which shows a ring of tonic contraction (*R*) in the middle of the ascending colon (*AC*). Proximal to the area of contraction the colon is relaxed and moderately distended. The ring of contraction is at the proximal end of a general contraction of evacuation involving the superior part of the ascending colon, the hepatic flexure (*HF*), and the transverse colon (*TC*).

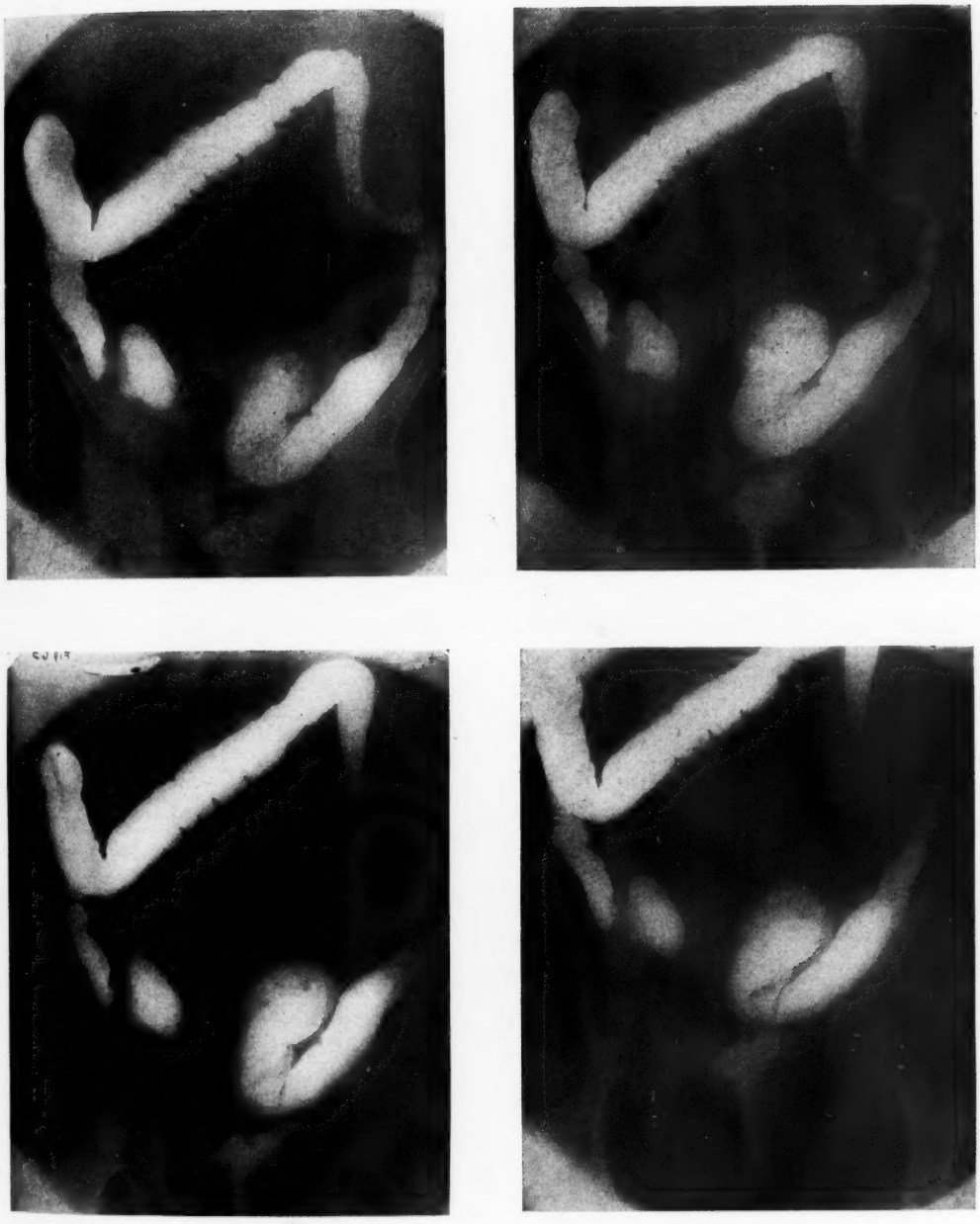

Fig. 63. Four roentgenograms made of the same individual during an examination of the colon, which show a constant ring of tonic contraction between the cecum and ascending colon. This was apparently a hyperactive pacemaker which was the source of a persistent diarrhea that developed on the least excitation or worry. In spite of the constancy of this annular ring of contraction, the presence of normal mucosal folds within the area of contraction demonstrates that it is not due to an organic lesion and enables one to make a negative diagnosis of cancer.

FIG. 1418.

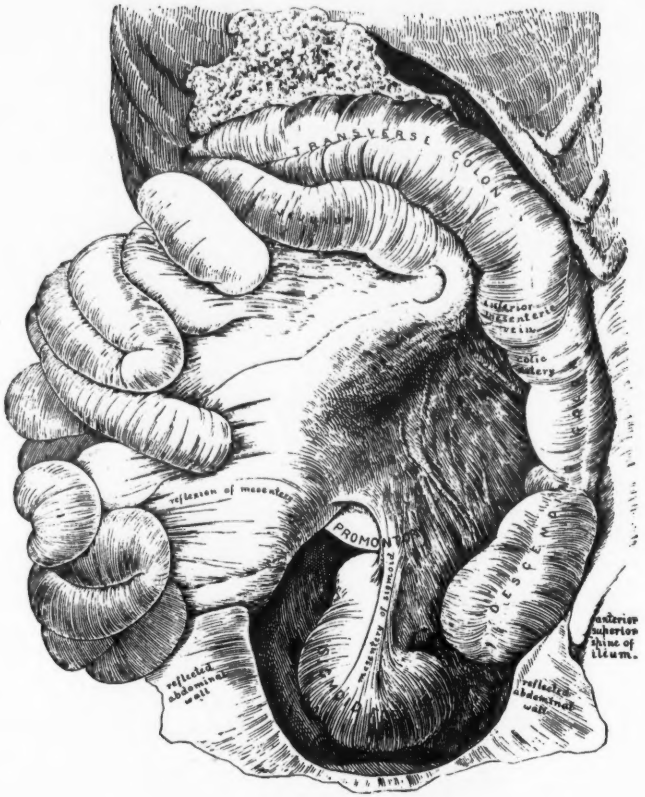

Fig. 64. Reproduction of an anatomical drawing from Quain's text-book on anatomy. Left side of abdomen: small intestine turned to right, exposing mesentery, mesocolon of descending colon, and mesosigmoid. At the junction of the descending and sigmoid colon, as labelled in the drawing, the colon is covered with a relatively narrow band of peritoneum. The roentgenographic findings of this anatomical formation are illustrated in Figure 65.

Fig. 65. Roentgenogram showing the descending and sigmoid colon moderately distended with a barium enema. At *PB* there is fixation of the colon by a band of peritoneum which does not allow the colon to expand as much as the adjacent parts of the colon. The anatomical basis for this finding is illustrated in Figure 64.

THE CAPACITY OF X-RAY TUBES AS INFLUENCED BY THE GEOMETRIC DESIGN OF THE FOCAL SPOT, INCLUDING THE ADVANTAGES AND LIMITATIONS OF THE LINE FOCUS PRINCIPLE

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Assisted by the National Research Council of Canada

IT MAY be fairly stated that the capacity of modern X-ray installations is limited only by the ability of the X-ray tube to utilize energy without prohibitive damage. The capacity of the X-ray tube is, in turn, limited largely by its ability to dissipate heat.

The heat-dissipating function of a tube is, however, of two distinct orders. One of these is concerned with the ultimate removal of heat from the anode, as by radiation and conduction. The other is invoked only when much energy is applied in a time interval which is short in terms of the time necessary for conduction of heat by the metal. Under these latter conditions, the tungsten on the immediate surface of the focal spot may be melted while the body of the anode is cold.

Exclusive of the use of a metal having higher specific heat, greater heat conductivity, or higher melting point, we know of only two ways by which the heat capacity of a focal spot may be influenced under large loads of split second duration.[1] The first of these is to start the exposure with a cold anode, and, if frequent exposures are necessary, water cooling is a boon to the radiologist for this purpose. The second method is to have the area of the focal spot as large as possible and thus to reduce the load per unit area to a minimum. As a corollary to this, it should be noted that uneven cathode-ray distribution diminishes the effective area of the focal spot by leaving spaces with sub-average radiation, while overloading adjacent parts.

The ability of a focal spot to utilize energy without damage is, however, meaningless in radiography unless correlated with the degrees of fineness of focus, otherwise we would use therapy tubes for radiography. The area of the focal spot is thus limited by the size of focus we are willing to employ under the conditions in use. Given this limit of size of focus, it is incumbent on the manufacturer to design into the tube the maximum possible focal spot area. This he may do by management of the geometric characters of the focal spot.

The efficiency of an X-ray tube under high-energy, short-exposure conditions, may then be expressed as the ratio of capacity to fineness of focus.[2] This in turn resolves itself into the ratio of the area of the focal spot to the effective size of the focus under the conditions in use.

It is the purpose of this paper to show the changes that occur in the area of the focal spot, and, consequently, in tube capacity, under varying conditions of focal spot design.

BASIS FOR CAPACITY DETERMINATIONS

Before proceeding to an analysis of varying geometric design, upon the area and consequent capacity of the focal spot, we must first review what is meant by "effective fo-

[1]The rotating anode constitutes a further principle by which surface capacity may be increased by moving cold metal into the field during the exposure.

[2]This presupposes that the amount of X-radiation reaching the film is constant for any slope of anode. There are apparently, however, no final physical data as to the relation of X-ray intensity in different directions, to the angle at which the cathode stream impinges on the focal spot. In practice, however, we have not observed any reduction of radiation over the film with line focus tubes as compared with 45° anodes, providing the tube is placed at the proper distance from the film as shown later in this article.

cus." Focal spot projection, or "focus," is illustrated in Diagram I, and consists of the parallel line projection of the focal spot upon the film. An object at any point on a film

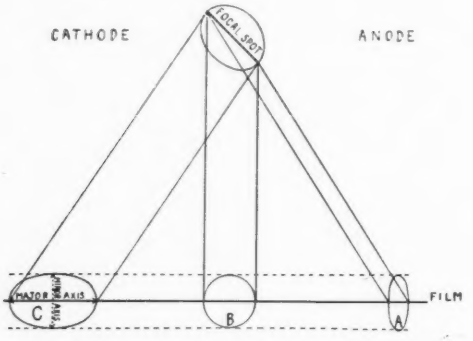


Diagram I. Focal spot projection in long axis of tube.

(as at A, B, or C) is, in effect, radiographed with a focal spot of the size and shape of this focal spot projection, and not with the characters of the focal spot itself. The "focus" is thus the measure of potential sharpness and radiability on the film as far as the tube itself is concerned. Actual sharpness and radiability, of course, depend also on other factors, the chief of which are the ratio of the object-film to the target-object distance, and the excellence of photographic reproduction.

It will be seen that the focal spot projection is quite different at different points on the film. Identical objects radiographed at the points A, B, and C will consequently cast shadows of quite different characteristics. Sharpness of shadow will depend on, *i.e.*, be inversely proportional to, the diameter of the projection figure in any direction, and there will be a varying degree of distortion in the shape of the image at different film positions. Since the dimensions of the projection figures become smaller as we proceed from the cathode to the anode end of the film, it follows that sharpness of shadow will also improve in this direction. In addition, except at the center of the film where the projection figure may be circular, sharpness of shadow will vary in different directions at any given point, corresponding to the varying diameters of the projection figure. These characters are also shown in Diagram VI.

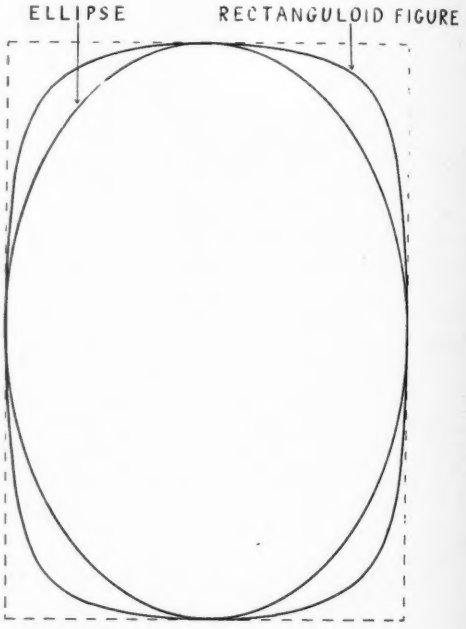


Diagram II. Elliptical and rectanguloid focal spot shapes in a circumscribed rectangle.

Since the focus of a tube is so widely variable, it is necessary to deduce a practical or *effective* focus that may be used as an index to radiability over a film as a whole. In a former publication[3] it has been shown that the average of the longest and shortest diameters (major and minor axes) of the projection figure at the middle of the cathode end of a film (Pos. C, Diagram I) offers a fair "effective value" of the focus. This value will, of course, vary with the size of the film, with the target-film distance, and with the geometric characters (slope, shape, etc.) of the focal spot.

(Although the mean of the major and

[3]P. M. Andrus and A. Hambleton: RADIOLOGY, June, 1931, XVI, 869-880.

minor axes of the projection figure is a perfectly satisfactory approximation of the value of the focus at a point [for elliptic focal spots] it is shown in the foregoing communication that this value is more correctly expressed by the average distance between all parallel tangents to the projection figure. Since the present study is a theoretic consideration of the efficiency of varying focal spot designs, this latter figure has been used in the derivation of efficiency data.)

Technical Methods.—The determination of the focal spot area associated with any size or shape of projection figure is, of course, a matter of projective geometry.

The determination of the average distance between parallel tangents to any projection figure was made by taking the average distance between parallel tangets at five-degree intervals around the figure. Although this may be done mathematically to incorporate *all* parallel tangents, the methods are too involved to be applicable to this problem. In the case of elliptic projection figures (*i.e.*, cast by an elliptical focal spot) the determinations were mathematical. In the case of projection figures other than a true ellipse, purely mathematical determinations are, again, impracticable or impossible. For these conditions the projection figures were drawn to large scale on co-ordinate paper, and the tangents drawn at five-degree intervals and measured. Areas were computed by the method of counting squares.

The values given in the tabulations are in each case that area of focal spot which projects unit focus at the cathode end of the film. The actual focus is converted to unity by the formula $\frac{\text{Area of Focal Spot}}{(\text{Effective Focus})^2}$ In this way the areas of different designs of focal spot are made directly comparable.

The Geometric Shape of the Focal Spot.—This resolves itself into an analysis of the relative efficiency of elliptic focal spots *versus* figures of different geometric shape, but with the major and minor axes of the same size as those of the elliptic focal spots.

Such figures are shown in Diagram II in a circumscribed rectangle. The larger

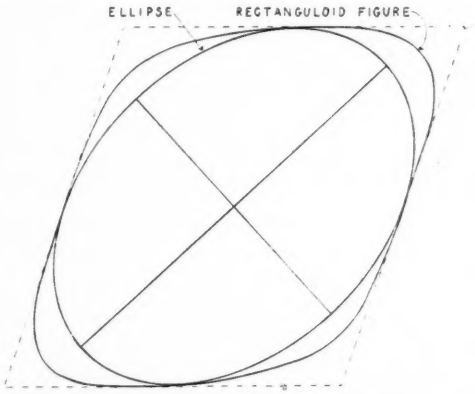


Diagram III. Elliptical and rectanguloid projection figures at cathode corner of film.

figure has the shape of the focal spot commonly seen in "line focus" tubes. The diagonal of this figure is 83 per cent, and the area is 92 per cent of that of the circumscribed rectangle. The area of an ellipse is 78.54 per cent of that of the circumscribed parallelogram. The efficiency of this rectanguloid focal spot, as we shall call it, compared with an elliptic focal spot, depends upon which of these geometric shapes has the larger area when both project unit size of focus at the cathode end of the film.

TABLE I.—AREA OF FOCAL SPOT FOR UNIT FOCUS

Film Position	Ellipse	Rectanguloid Figure	Gain by Ellipse
Film center	1.111	1.056	5.20 per cent
Mid-cathode end	0.804	0.770	4.42 per cent
Mid-anode end	1.610	1.522	5.78 per cent
Cathode corner	0.864	0.754	14.59 per cent
Anode corner	1.590	1.487	6.92 per cent
Mid-lateral edge	1.055	1.040	1.44 per cent
Mean gain in area by ellipse			6.39 per cent

Table I shows the area of focal spots, both elliptical and rectanguloid, which project unit focus at various points on a

film. The conditions are for a 45° slope of anode at 24 inches target-film distance, centered over the 17-inch length of a 14 × 17 inch film. It will be seen that the area of the elliptic focal spot is larger than that of the rectanguloid focal spot for all points of the film, *i.e.*, the capacity and efficiency of the elliptical focal spot are greater. It is also seen that the difference in efficiency is most pronounced at the corners of the film. This is due to the fact that the projection figures[3] slope outwards at all points other than along the mid-axis of the film. The projection figures from a rectanguloid focal spot under these conditions suffer asymmetrical distortion as shown in Diagram III. The result is an increase in the size of the "effective focus" at a greater rate than that which takes place in the case of elliptical projections.

In contrast to this, the projection figures cast by an elliptical focal spot remain true ellipses under all conditions of slope and thus retain their symmetry over all parts of the film.

Similarly, for projection figures having a smaller area than that of an ellipse of the same major and minor axes, we have shown that the area of the focal spot which projects unit focus remains larger in the case of the ellipse.

Although we have been unable to obtain a purely mathematical proof for the general case, we deduce from these data that the ellipse is the most efficient possible geometric shape of focal spot design.

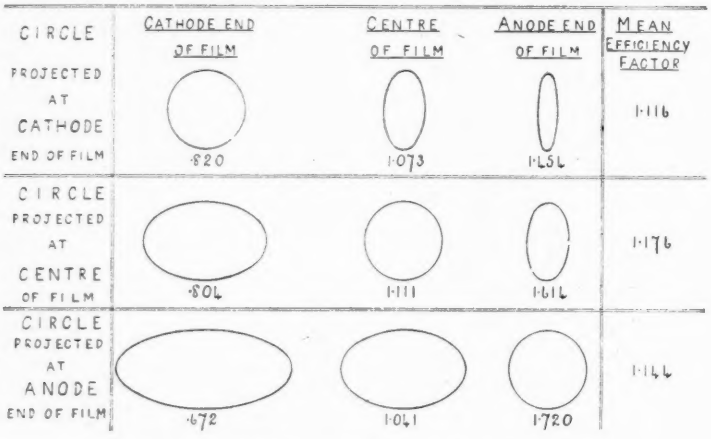


Diagram IV. Efficiency of types of focal spot projection.

A further disadvantage of the rectanguloid focal spot is that the shadow cast by a small spherical object is given flattened sides, corresponding to the flattened sides of the focal spot, *i.e.*, there is increased and asymmetrical distortion of shadow.

THE RELATIVE DIMENSIONS OF THE FOCAL SPOT

The relative dimensions of the focal spot, *i.e.*, the ratio of the major to the minor axis, is determined for a given slope of the anode by the relative dimensions of the projection figures it is desired to cast upon the film. Diagram IV illustrates different types of elliptical film projections. The middle row illustrates the type of projection figures of the usual 45° anode tubes, *i.e.*, a circle is projected at the center of the film. To project the type of ellipses shown in the top row, the major axis of the focal spot would

be shortened and the area therefore decreased; to project as in the lower row, the major axis would be lengthened and the area increased. Unless the focal spot is parallel to the film, it is apparent that a circle may be projected at only one point at a time. In determining the type of elliptical projections that is most desirable, it is, in the first place, fundamental that the most efficient possible geometric shape of projection figure is the circle. That is, a focal spot of given area will produce the greatest possible average sharpness at a point on a film, if the shape of the focal spot is such as to give a circular projection figure at that point. There remains to determine at what point on a film the circular focus should be projected for the greatest benefit to the film as a whole. The figures in the diagram are the area of focal spot which projects unit focus at the point depicted. The data refer to a 17-inch film length at 24 inches target-film distance.

It will be observed from the diagram that efficiency at the cathode end of the film is greatest when the circular focus is projected at that point. Since this projection has been shown to be the most reliable index to radiability over the film as a whole,[3] it would seem desirable to design the focal spot to give the greatest possible efficiency at this location. There are, however, certain objections to this type of projection: 1. The gain is localized, and is obtained at the expense of efficiency over the film as a whole (see center and anode positions, and mean efficiency). 2. Symmetric distortion of shadow is obtained only where the focal spot projection is circular, hence the inevitable distortion of shape of shadow will be at a minimum when the circular focus is projected at the center of the film. 3. As film size is increased or target-film distance lessened with a given tube, the resulting changes in projection are least unfavorable when the circular focus is projected at the center of the film.

In view of the above data, and since the gain is less than 2 per cent under the most extreme conditions, we are of the opinion that this fractional improvement is not

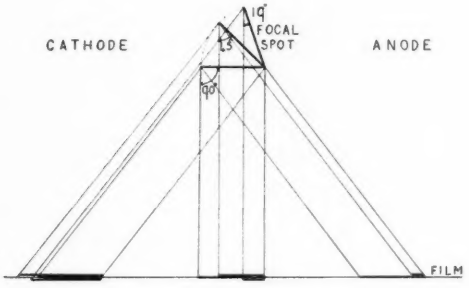


Diagram V. Effect of slope of anode on film projection.

earned and that the circular focus should be projected at the center of the film.

Projection of the circular focus at the anode end of the film results in very poor efficiency at the more important cathode end of the film and should not be employed.

The increasing efficiency from the cathode to the anode end of the film is simply an expression of the commonly observed increase in sharpness in this direction.

The Slope of the Focal Spot Surface.— The effect on film projection of the angle of slope of the focal spot is shown in Diagram V. As the focal spot surface is rotated towards the perpendicular (perpendicular to the film), it is seen that the projections at the center and at the anode end of the film become rapidly smaller. It is apparent also that the anode end of the film may be placed behind the anode surface of the tube, and no radiation be obtained over this area. From the diagram it is seen that projection conditions throughout the film improve as the slope of the anode approaches the perpendicular. This may be conversely stated, that, for a given film projection, the length (and therefore area and capacity) of the focal spot increases as the anode surface approaches the perpendicular. This is the principle of the line focus tube.

This slope is, however, limited by two factors; first, the necessity for radiating the entire film (specifically the anode end), and, secondly, the difference between the maximum and minimum projection over the film (distortion) that we are willing to allow. Both of these factors are dependent, in addition to the slope of the anode, upon the ratio of the film size to target-film distance in use.

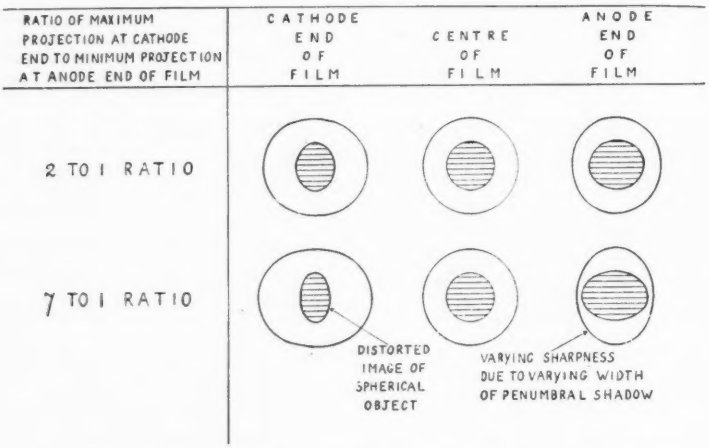

RATIO OF MAXIMUM PROJECTION AT CATHODE END TO MINIMUM PROJECTION AT ANODE END OF FILM
CATHODE END OF FILM
CENTRE OF FILM
ANODE END OF FILM
2 TO 1 RATIO
7 TO 1 RATIO
DISTORTED IMAGE OF SPHERICAL OBJECT
VARYING SHARPNESS DUE TO VARYING WIDTH OF PENUMBRAL SHADOW

Diagram VI. Images of a spherical object at different parts of a film.

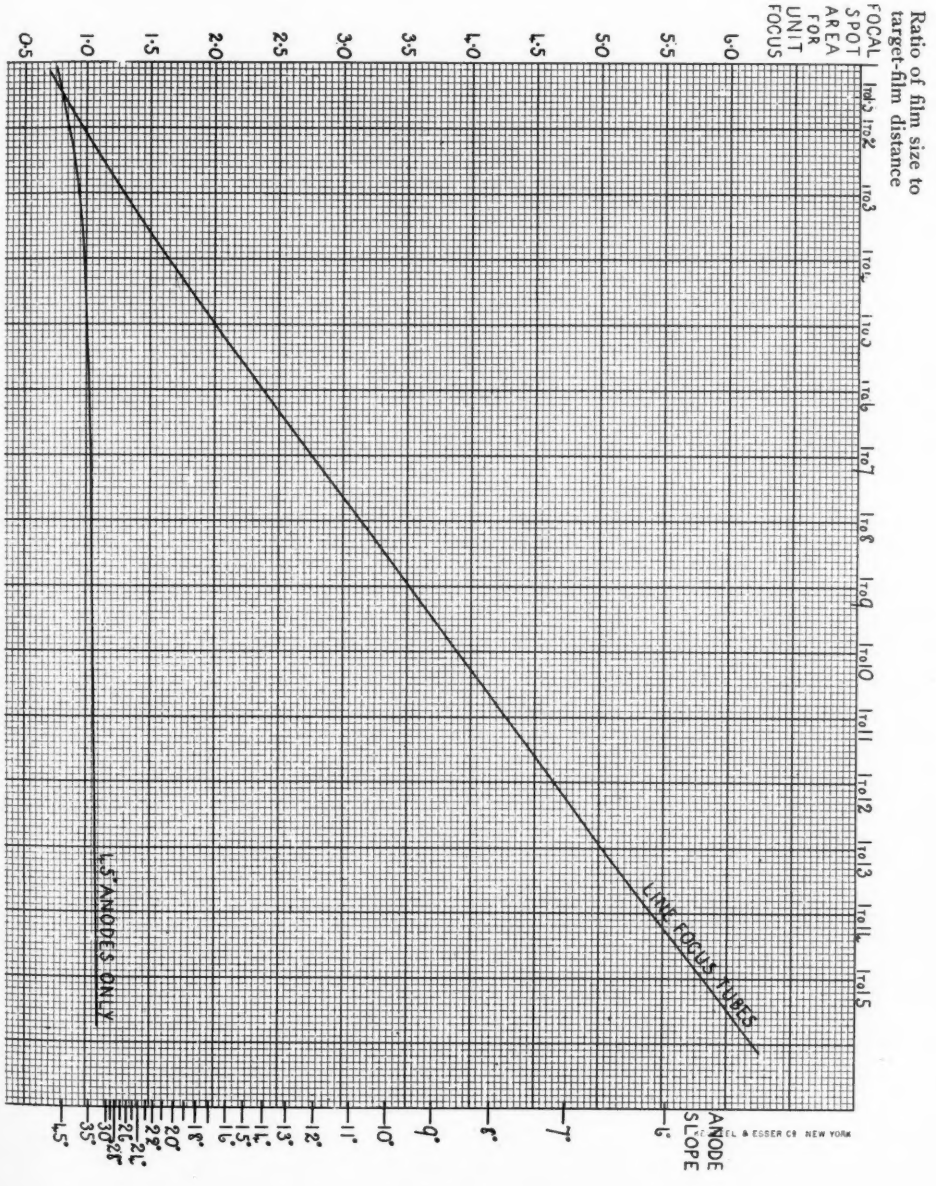
In determining the ideal degree of anode slope, it must be realized that we cannot design a single tube to function with equal efficiency under different conditions. The greater the tube distance and the smaller the film size we are willing to use, the greater the *relative* efficiency that can be designed into the tube.

Focal Spot Projection Ratios.—We have first then to set a limit to the ratio of the maximum to the minimum projection that we are willing to permit over a film. This determines the degree of difference in sharpness between the two ends of the film and the degree of distortion of shape of shadow. The radiographic effect of different ratios of projection is shown in Diagram VI. These are the shadows that would be cast by spherical objects over different parts of the film by an elliptical focal spot. In each case at the center of the film the shadow is circular, and the penumbral shadow is of uniform width in all directions. At this point then the sharpness is uniform in all directions and distortion of the size and shape of the shadow is symmetrical, *i.e.*, the shadow of a sphere is projected as a circle. At the cathode end of the film, however, the shadow proper is flattened and at the anode end of the film it is elongated. In addition, the width of the penumbral shadow (sharpness) varies markedly in different directions in these two positions. The figure shows the radiographic effects of a two-to-one and of a seven-to-one ratio between the projections at the anode and cathode ends of the film. The distortions increase with the ratio of maximum to minimum projection in effect, and we must decide what ratio we are to allow in designing the focal spots.

From the study of a series of such preparations, using inanimate objects and living tissues, we have concluded that a ratio of two to one between the maximum projection at the cathode end of the film and the minimum projection at the anode end of the

film should not be exceeded, and that a lower ratio is preferable when possible.

Relation of Slope of Anode to Focal Spot Area and Capacity.—Graph I shows the efficiency of any slope of anode over any size of film at any target-film distance, subject to the conditions that (1) the focal spot is elliptical; (2) the circular focus is projected along the central ray of the tube, and (3) that a two-to-one ratio between the maximum projection at the cathode end of the film and the minimum projection at the anode end of the film is not exceeded. The efficiency factor as before is simply the area



Graph I. Relation of anode slope to focal spot area (and capacity).

of focal spot which projects unit focus at the middle of the cathode end of the film, the target, of course, being centered.

At the right-hand edge of the graph is given the degree of slope, and at the left-hand edge the corresponding area of the focal spot. The figures across the top give the ratio of the film size to the target-film distance. For example, a ratio of one to six represents a film size of four inches at 24 inches target-film distance, or a film size of 12 inches at 72 inches, etc.

The graph in the first place shows the minimum target-film distance at which any slope of anode may be placed without exceeding a two-to-one ratio between the maximum and minimum focal projections. For example, let the long axis of a tube with 20° slope of anode be centered over a 14-inch film length. Tracing the 20° position to the left until it meets the graph line, and then upwards, it is seen that a film-size to target-film distance ratio of approximately 1 to 4.2 may be used. Multiplying each side of this ratio by the film size, we find that a 14-inch film size calls for a minimum target-film distance of $14 \times 4.2 = 58.8$ inches for this slope of anode. If the 20° line is then followed across to the left-hand column, it is seen that 1.70 is the area of this focal spot which will produce unit focus. To compare the efficiency of this tube with that of a 45° slope of anode, reference should be made to the nearly horizontal graph line across the bottom of the page. For the same film size ratio (*i.e.*, 1 to 4.2), it will be found that the area of the focal spot of the 45° anode is 0.99 as compared with an area of 1.70 for the 20° anode. Thus the 20° anode tube has a capacity of $\frac{1.70}{0.99} = 1.72$, or 72 per cent greater than that of the 45° tube under the same conditions.

Similarly a 14° anode is shown to have a focal spot area of 2.38 as compared with 1.04 in the case of a 45° tube. The area and capacity of the 14° focal spot is thus about 2.3 times greater than that of the 45° tube.

Following the 14° point on the graph line to the top of the page, however, it is seen that the necessary film size ratio is about 1 to 6.0. This means that the 14° anode, if used over a 14-inch film length, must be placed at a target-film distance of $14 \times 6.0 = 84$ inches, or 7 feet. The 45° tube, on the contrary, may be placed as close as 21 inches to a 14-inch film without exceeding the two-to-one projection ratio.

Glancing at the still smaller slopes of anode, capacities of four and five times that of the 45° tubes appear tempting. However, it will be seen that, to use these tubes, target-film distances of the order of 12 to 15 feet must be employed to cover a 14-inch film length as in chest radiography. Such distances are apt to exceed the capacity of commonly used equipment.

Practical Considerations.—The preceding example shows that a 14° slope of anode may be used over a 14-inch film length[4] at seven feet target-film distance, and has a capacity 2.3 times greater than that of a 45° anode giving the same sharpness. Such a tube then should be useful in radiography of the chest. In determining the minimum target-film distance that may be employed, however, it should be pointed out that some latitude is afforded by reason of the fact that the part radiographed rarely covers the entire film. Thus chests exposed at six feet or more rarely occupy more than 12 inches of the 14-inch film length. If, then, for the case of the 14° anode we provide for a useful film size of 12 inches instead of 14 inches as above, the necessary target-film distance is reduced to $6 \times 12 = 72$ inches, or six feet. This reduction might make possible exposures for which sufficient

[4]It is shown in a previous publication[3] that the long axis of the tube should always be placed along the short axis of the film; and that for stereoscopy the tube should always be tripped in its own lateral axis, *i.e.*, along the longer axis of the film.

energy was otherwise not available. However it is preferable to use the film dimension as the basis of computation except when limited by resources of energy or by tube capacity.

Similarly an 18° slope of anode could be used for chest exposures at 65 inches, and have a capacity of 85 per cent greater than that of a 45° anode giving the same sharpness at the same distance.

If in the future we are willing and able to use still greater tube distances, it is seen from the foregoing that much greater relative capacity can be designed into tubes for chest work by using still smaller slopes of anode.

Consider the use of the line focus type of tube in radiography of other parts of the body. Graph II shows, for example, the dimension of film that may be covered by an 18° anode at the shorter target-film distances. Since the conventional X-ray table assembly sets a practical limit in the neighborhood of 36 inches to the target-film distance that may be employed, let us see what radiographic procedures may be legitimately conducted using such a structure.

The graph shows that the limit of film dimension under these conditions is set at eight inches for a 37-inch target-film distance for this particular slope of anode. This permits the use of an 8 × 10 inch or an 8 × 12 inch film. These sizes, or smaller, are adequate for exposure of the extremities, including the hip joints and shoulder joints, for the cranium, and for sections of the spine. Radiographs of longer sections of the spine are unsatisfactory in any event, as quite different exposures are required in different regions. Smaller film sizes may be used at shorter target-film distances as shown by the graph. For instance, the 5 × 8 inch half of an 8 × 10 inch film may be used for radiographs of the sinuses at 24-inch target-film distance, the long axis of the tube being placed along the 5-inch dimension of the film.

But how, then, is radiography to be conducted when larger film dimensions are needed? In the first place, if it is necessary to expose a 14- or a 17-inch film length at 25-inch target-film distance, it is seen from Graph I that only a 45° anode may be used. In the case of an 18° anode, it is seen from Graph II that for a 10-inch film length (10 × 12 inch film) a target-film distance of 46.5 inches is indicated, and, for a 12-inch length, a target-film distance of 56 inches is required, *i.e.*, approaching four and five feet, respectively. The choice lies between using these unusually long target-film distances, or using an anode of lesser slope. When possible, the preference should invariably be for the former.

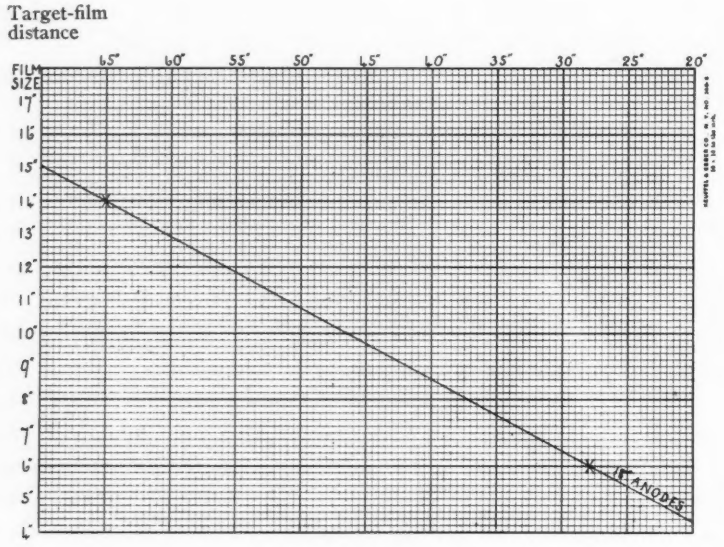
The trend of development in X-ray equipment is distinctly towards the use of generators of large capacity and tubes of increased capacity. The increased capacity made available by the line focus principle should be used to improve sharpness and radiability in detailed structures, and, aside from the attaining of speed where movement is a factor (thorax), should be employed to attain increased target-film distance.

It is apparent that X-ray table equipment should provide for such increased target-film distances in order to keep pace with this trend of developments.

Failing the use of adequate target-film distances, one has the option of using a lesser slope of anode, with consequent lessening in capacity, or of using smaller film sizes, *i.e.*, radiographing more limited areas at a time.

The user of line focus type tubes would do well to construct for himself a graph line for each slope of anode he may have in use. To construct the line as in Graph II, for example, for an 18° anode, proceed as follows: In Graph I, follow the 18° position to the left to the graph line and from thence to the top of the page. This will indicate the ratio of film size to target-film distance to be 1 to

4.65. The target-film distance is thus 4.65 times the film length. A 6-inch film then calls for $6 \times 4.65 = 27.9$ inches target-film distance, and a 14-inch film requires $14 \times 4.65 = 65.1$ inches target-film distance. It is necessary only to plot these two positions by crosses and join their centers with a straight edge. Any number of tubes may be thus represented upon a single sheet of co-ordinate paper.



Graph II.

The Determination of the Slope of the Anode.—In order to use the material in this paper, it is of course necessary to determine the slope of the anode. The manufacturer should supply these data with each tube as well as the dimensions of the central ray projection of the focal spot. We presume this will be supplied on request. The slope of the anode may be approximately measured in the case of tubes with glass bulbs. Support the tube over a sheet of white paper on which is a long, straight ink mark, and line up the central axis of the tube with this mark by eye. Place a straight edge to coincide in direction with the face of the anode and mark the edge. With a protractor measure the angle between this line and a perpendicular to the line representing the axis of the tube.

In the case of tubes with metallic discharge chambers, the user will have to depend on the manufacturer for these data. Projection methods of measuring the slope of such anodes will be published at a later date, but are not suited to use by the practical radiologist. Failure to observe the restrictions as to target-film distance laid down in this paper may invoke penalties as enumerated below.

1. Undue distortion of shape of shadow, *i.e.*, identical objects may give unduly different radiographic characters of shadow at different parts of the film.

2. There may be undue variation in the degree of sharpness over different parts of the film.

3. Actual sharpness is apt to be defective, as the size of the focal spot is in general adjusted by the manufacturers to be suitable for use at the distances which the slope of the anode permits.

4. The full efficiency of the tube is not

realized, *i.e.*, the sharpness that may be attained for a given amount of energy is not obtained.

5. The anode end of the film may suffer from lack of radiation.

SUMMARY

1. The design of the focal spot of the X-ray tube is analyzed in terms of the area of the focal spot in relation to sharpness of focus.

2. It is shown that the efficiency of the "line focus" type of focal spot may be substantially greater than that of the 45° slope of anode.

3. It is shown that the "line focus" type of focal spot has limitations as to the film distance at which it may be employed. These distances are tabulated for practical use, and it is shown that failure to observe these limitations may lower the efficiency below that of the 45° anode.

X-rays Detect Lead Poisoning in Children.—A new method of diagnosing lead poisoning by means of X-rays has been reported by Dr. Edward C. Vogt, of the Infants' Hospital and the Children's Hospital, Boston. When lead is absorbed into the body it is stored in the bones and can be detected in the X-ray films as a dense band at the growing margin. Its elimination following treatment can also be observed by means of X-ray films.

Dr. Vogt pointed out that lead poisoning is a frequent and serious condition in children and one not always easy to diagnose. The dark line, called the "lead line," at the margins of the gums is significant of the disease in adults but is seldom seen in small children, and the other diagnostic tests require considerable technical skill.

The X-ray test for lead poisoning cannot be used alone, Dr. Vogt pointed out, as some other conditions give the same or nearly the same picture, but together with other evidence, such as a history of chewing painted toys, it is very useful.—*Science Service.*

FUNCTIONAL INTERRELATIONSHIPS OF THE THYROID GLAND AND THE AUTONOMIC NERVOUS SYSTEM[1]

By ALBERT KUNTZ, M.D., St. Louis, Missouri

THE nerve supply of the thyroid gland is derived in part from the cervical sympathetic trunks and in part from the vagus nerves. In man, the sympathetic nerves to the thyroid gland arise mainly from the middle cervical ganglion or, in the absence of this ganglion, directly from the cervical sympathetic trunks. These nerves probably include fibers arising in all the cervical sympathetic ganglia. Nonidez (9) recently described a definite bundle of fibers arising in the superior cervical ganglion and entering the corresponding lobe of the thyroid gland of the dog. He expressed the opinion that the superior cervical sympathetic ganglia are the sources of most of the sympathetic fibers which enter the thyroid gland. Since the thyroid gland develops as a diverticulum from the floor of the embryonic pharynx, a portion of the digestive tube which receives its sympathetic nerve supply chiefly from the superior cervical ganglia, this opinion seems to be well founded. The fibers of vagus origin which enter the thyroid gland are mainly components of the superior laryngeal nerve and include both afferent and efferent fibers. The terminal relationships of the efferent vagus fibers could not be interpreted on the basis of the findings of the earlier investigators. Since the existence of ganglion cells both in the superior laryngeal nerve (6) and the thyroid gland (9) has been demonstrated in certain animals, particularly the dog, it may be assumed that efferent components of the vagus terminate in relation to these cells. They are multipolar and probably represent parasympathetic neurons.

In the light of these findings, it may be assumed that the thyroid gland, like most of the other visceral organs, is supplied by both sympathetic and parasympathetic nerves. The thyroid gland is abundantly supplied with blood vessels. Not a few investigators have failed to observe nerve fiber terminations in relation to the thyroid follicles or gland cells, and, consequently, have assumed that the nerve fibers which enter the thyroid gland are distributed mainly to the blood vessels. The majority of the more recent investigators who have studied the distribution of nerve fibers in the thyroid gland support the theory that the fibers terminate both in relation to the thyroid follicles and in the walls of the blood vessels.

Certain of the older physiologists, particularly Poincare (1875), advanced the theory that the thyroid gland is supplied by secretory nerves, although experimental data were not at hand. Of the later investigators, some have advanced experimental data which seem to indicate that thyroid activity is subject to direct nervous influences; others were unable, on the basis of their experimental findings, to concur in this opinion. Of the latter group, not a few supported the theory that the secretory activity of the thyroid gland is influenced by the blood supply to the gland; consequently, thyroid activity is influenced indirectly by the vasoconstrictor and vasodilator nerves.

In an investigation undertaken to determine the possible direct nervous influence on the secretory activity of the thyroid gland, Wiener (15) cut the various nerves to the thyroid on one side and later compared the lateral halves of the gland with respect to weight and thyroglobulin content. In his experiments, section of the vagus, or extirpation of the superior cervical sympa-

[1]Read before the Radiological Society of North America at the Seventeenth Annual Meeting, at St. Louis, Nov. 30–Dec. 4, 1931.

thetic ganglion, brought about no apparent changes in the gland or in its thyroglobulin content. Extirpation of the inferior cervical sympathetic ganglion, however, was followed by diminution in the size of the gland on the side of the operation and a decrease in its thyroglobulin content. He, therefore, concluded that the sympathetic innervation of the thyroid exerts both trophic and secretory influences.

Asher and Flack (1) assumed the existence of secretory nerves to the thyroid gland mainly by reason of the fact that stimulation of the laryngeal nerves brings about the same heightened excitability of the depressor nerve and increased effect of adrenalin on blood pressure as is brought about by the intravenous injection of thyroid preparations. Asher and Rodt (3) also observed that the excitability of the splanchnic nerves is heightened during stimulation of the nerves to the thyroid gland.

In a further experimental investigation, carried out under Asher's direction, Ossokin (11) corroborated the findings of the earlier investigators who maintained that the nerves to the thyroid gland convey both vasoconstrictor and vasodilator fibers. He also reported that vagus excitability is increased during stimulation of the nerves to the thyroid gland. More recently Asher and Pflüger (2) reported experimental findings which seem to indicate that sympathetic denervation of the thyroid results in diminution of the capacity of the body tissues, particularly the subcutaneous connective tissue and muscles, for absorption. They concluded, on the basis of these findings, that at least some of the normal functions of the thyroid gland depend on its sympathetic innervation.

In perfusion experiments on the thyroid of the dog, with the nerve supply intact, only by the use of adrenalin could Sturm (13) elicit the discharge of iodine-containing material into the perfusion fluid. According to Vogt (14), partial sympathetic denervation of the thyroid gland in rats and its complete sympathetic denervation in rabbits failed to influence the capacity of the thyroid to adjust itself to wide variations in the intake of food.

The experimental data at hand seem to demonstrate the existence of both vasomotor and secretory nerve fibers to the thyroid gland. The effect of secretory fibers is less evident, however, in the activity of the thyroid gland than in that of certain others, *e.g.*, the salivary glands. Vasomotor changes in the thyroid probably play an important rôle in its secretory activity. The possible effect of direct secretory fibers, however, cannot be disregarded, but the data available at present do not afford a basis for the evaluation of the rôle of these fibers either in the functional regulation of the thyroid under normal conditions or under conditions of hypo- and hyperthyroidism.

On the basis of clinical observations, it must be conceded that hyperactivity of the thyroid gland is accompanied by nervous hyperirritability. The specific effect of the thyroid secretion on the nervous system, however, is not fully known. The data available seem to indicate that the thyroid secretion affects mainly the sympathetic division of the autonomic system, but, under certain conditions, it also affects the parasympathetic nerves. Many of the experimental data bearing on this point are inconclusive. For example, Lieb and Hyman (7) have shown that repeated injections of adrenalin in experimental animals increasingly augment irritability of the sympathetic nerves, regardless of the functional condition of the thyroid gland. In a study of the effect of thyroidectomy on sympathetic irritability, Hoskins (5) was unable to obtain consistent results in the various experimental animals used, probably due to varying effects

of this procedure on the sympathetic and parasympathetic divisions of the autonomic system.

The results of experimental studies reported recently by Bergwald and Kuschinsky (4) are more significant. These investigators have shown that thyrotoxicosis, induced by the administration of thyroxin, results in sympathetic hyperirritability by reason of an increased output of adrenalin, *i.e.*, thyroxin poisoning results in increased secretory activity of the adrenal glands. These results strongly suggest that sympathetic hyperirritability in cases of hyperthyroidism may arise as an indirect result of the stimulating effect of the increased output of the thyroid secretion on the adrenal glands. These investigators also showed that the direct action of thyroxin is essentially peripheral. Certain observations of Oberdisse (10) also indicate that thyroxin in the blood stream may exert a direct effect on the tissue elements.

Although the results of experimental investigations show clearly that the thyroid gland is subject to nervous influences under experimental conditions and that the thyroid secretion acts as a sympathetic stimulant, the functional interrelationship of the thyroid gland and the autonomic nervous system, as suggested by the experimental data, is not clear-cut. Whatever influence the thyroid secretion exerts on the nervous system probably is exerted mainly on the sympathetic nerves. Under certain conditions, however, it also influences the parasympathetic nerves. This non-specific action of the thyroid secretion cannot be explained on the basis of any experimental data available at present.

In view of the fact that the results of experimental investigations fail to show a constant and clear-cut functional interrelationship of the autonomic nervous system and the thyroid gland, it is hardly to be expected that the clinical picture in thyroid disease should be constant and clear-cut. The dominant symptoms of hyperthyroidism, *viz.*, tachycardia, exophthalmos, increased metabolism, fever, etc., are manifestations of sympathetic stimulation. The hyperperistalsis, which so commonly is associated with hyperthyroidism, on the other hand, is a manifestation of parasympathetic stimulation. The functional balance of the autonomic nervous system is disturbed, but the symptom complex as a whole suggests neither clear-cut sympatheticotonia nor clear-cut vagotonia.

In the genesis of thyroid disease, the importance of a pre-existing functional imbalance of the autonomic nervous system is unknown. Data are not wanting, however, which support the theory that hyperthyroidism is of neurogenic origin in certain cases. Not infrequently the symptoms of hyperthyroidism may be recognized in the absence of any demonstrable lesion of the thyroid gland. In certain cases, it has also been possible to trace the cause of thyroid hyperactivity to a specific lesion of the cervical sympathetic. For example, Herzen reported a case of unilateral thyroid hyperactivity due to compression of the cervical sympathetic by a fractured clavicle. In this case, the symptoms of thyroid hyperactivity subsided following removal of the pressure by reduction of the fracture. Symptoms of hyperthyroidism brought about by stimulation of the thoracic sympathetic trunk also have been reported. According to Stämmler (12), Mogilnizcky (8), and others, hyperthyroidism frequently is accompanied by pathologic changes in the autonomic ganglia and ganglion cells. These changes have been studied mainly in the ganglia of the sympathetic trunks, and are such as would suggest hyperactivity of the sympathetic ganglion cells. There is also a degree of parallelism between the severity and duration of thyroid hyperactivity and the extent of the changes in the sympathetic ganglion cells. Similar changes in the autonomic

ganglion cells also occur in association with other diseases, including acute and chronic infectious diseases. In infectious diseases such changes must be regarded not as a cause but as a result of the disease. To what extent changes in the sympathetic ganglion cells, indicating hyperstimulation, play a rôle in the genesis of hyperthyroidism is unknown. That sympathetic hyperirritability plays an important rôle in the course, termination, and sequelæ of the disease cannot be doubted.

Although in some cases pre-existing functional disturbance and pathologic lesions of the autonomic nervous system must be regarded as etiologic factors in hyperthyroidism, in the majority this condition probably arises as a primary disease of the thyroid gland. Since certain of its dominant symptoms, including tachycardia, exophthalmos, perspiration, and diminished gastric secretion, are directly referable to increased sympathetic stimulation, probably due to the increased output of the thyroid hormone, it must be admitted that the autonomic nervous system plays an important rôle in the symptom complex associated with hyperthyroidism. This factor merits greater consideration in the treatment of the disease than is usually accorded it, since the sympathetic hyperirritability resulting from this disease, or associated with it, in turn affects the thyroid gland unfavorably. Measures which tend to restore the functional balance of the autonomic nervous system, therefore, would also tend to remove one of the chief sources of irritation of the thyroid gland.

REFERENCES

(1) Asher, L., and Flack, M.: Die innere Sekretion der Schilddrüse und die Bildung des inneren Sekretes unter dem Einflusz von Nervenreizung. Ztschr. f. Biol., 1911, LV, 83-166.

(2) Asher, L., and Pflüger, O.: Nachweis der Abhängigkeit der Schilddrüsenfunktion vom Sympathicus, mit Hilfe einer neuen Methode. Klin. Wchnschr., 1927, VI, 1614.

(3) Asher, L., and Rodt, W. E. V.: Die Wirkung von Schilddrüsen und Nebennierenprodukten und die sekretorische Innervation der Schilddrüse. Zentralbl. f. Physiol., 1912, XXVI, 223.

(4) Bergwald, A., and Kuschinsky, G.: Erregbarkeitsänderung des Sympathikus durch Thyroxin. Arch. f. exper. Pathol. u. Pharm., 1931, CLXII, 169-182.

(5) Hoskins, R. G., and Lee, M. O.: The Internal Secretion and the Autonomic Nervous System. Research Publications, Assn. for Research in Nervous and Mental Division, 1930, IX, 352-365.

(6) Lemere, F.: The Ramus Anastomoticus and Ganglion Cells of the Superior Laryngeal Nerve. Anat. Record, 1931, XLVIII, suppl. 4.

(7) Lieb, C. C., and Hyman, H. T.: Studies of Graves' Syndrome and the Involuntary Nervous System. Vascular Response of Pithed Cat to Single Intravenous Injection of Adrenalin. Am. Jour. Physiol., December, 1922, Part IV, LXIII, 60-67; Part V, 68-82; Part VI, 83-87.

(8) Mogilnizcky, B.: Zur Frage der pathologischen Veränderungen des vegetativen Nervensystems bei Erkrankungen der endocrin Drüsen. Virch. Arch., 1923, p. 257.

(9) Nonidez, J. F.: Innervation of the Thyroid Gland; the Presence of Ganglia in the Thyroid of the Dog. Arch. Neurol. and Psychiat., June, 1931, XXV, 1175-1190.
Ibid: Innervation of the Thyroid Gland; Origin and Course of Thyroid Nerves in the Dog. Am. Jour., Anat., July, 1931, XLVIII, 299-329.

(10) Oberdisse, K.: Stoffwechseluntersuchungen zur Frage des Angriffspunktes der Schilddrüsensubstanz. Arch. f. exper. Path. u. Pharm., 1931, CLXII, 150-167.

(11) Ossokin, N.: Zur Frage der Innervation der Gl. Thyroidea. Ztschr. f. Biol., 1914, LXIII, 443.

(12) Stämmler, M.: Zur Pathologie des sympathischen Nervensystemo. Beitr. z. path. Anat. u. z. allg. Pathol., 1923, LXXI, 388-450.

(13) Sturm, A.: Beiträge zur Kenntnis des Jodstoffwechsels; Stoffwechselstudien an der überlebenden Schilddrüse; der Jodstoffwechsel der überlebenden künstlich durchströmten Hundeschilddrüse. Ztschr. f. d. ges. exper. Med., 1930, LXXIV, 514-554.
Idem: Beiträge zur Kenntnis des Jodstoffwechsels; Stoffwechselstudien an der überlebenden Schilddrüse; die Gewebsatmung der Schilddrüse und ihre Beeinflussungsmöglichkeit durch Jod und Hormone. Ztschr. f. d. ges. exper. Med., 1930, LXXIV, 555-574.

(14) Vogt, M.: Zur Frage der nervösen Regulation der Schilddrüsentätigkeit. Arch. f. exper. Path. u. Pharm., 1931, CLXII, 129-149.

(15) Wiener: Ueber Thyroglobulingehalt der Schilddrüse nach experimentellen Eingriffen. Arch. f. exper. Pathol. u. Pharm., 1909, LXI.

THE SURGICAL ASPECT OF THYROTOXICOSIS[1]

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ST. LOUIS, MISSOURI

A SOLUTION of the matter under discussion is simplified, we think, by asking ourselves four questions: (1) How does the problem in general impress a surgeon who has studied it for many years in a large number of patients? (2) What sort of individuals are these who are subject to this ailment? (3) What manner of clinical course is characteristic of it? (4) What therapeutic measures seem logical to one who has spent a large part of his professional life in trying to answer the first three of these four questions?

We realize that we are not addressing men who represent a cross-section of the medical world, but that our remarks are directed toward highly trained specialists who do not now practise, and many of whom never have practised, general clinical medicine. Hence possibly we do not see eye to eye, however desirous we may all be of keeping the open mind in every discussion of this sort. What follows has, therefore, no personal slant, since the men to whom this is presented probably see all of these patients in the capacity of consultant, whereas the real odium which attaches to therapeutic failure is in most instances to be borne either by the physician who first sees the patient or, indeed, in this malady of them all, by the patient herself.

Toxic goiter will, we think, impress us with its grave potentialities only when we consider that it gravely affects the three *vital* systems without any one of which life is not possible for more than a minute or two. We refer, of course, to the central nervous system, the circulatory system, and the respiratory system. Thyrotoxicosis in its gravest form is surely recognized by circulatory manifestations which are well known to you all, by nervous manifestations which are easily apparent to a casual observer, and by respiratory alterations which present themselves to all students of basal metabolism and to those conversant with our own work on the duration of voluntary apnea.

With this background of physiology in mind, let us ask ourselves if the malady is satisfactorily treated to-day. We were hardly able to answer this question until we made mortality studies on all the goiter patients who died in our service during the past six years. To our astonishment, and we may add to our melancholy satisfaction, we found that 38 per cent of these deaths occurred before operation, something which seems almost incredible in view of the promise held out to us a few years ago—that Lugol's solution would prevent what were termed "medical deaths" in thyrotoxicosis. Now, to make our position more clear as to who is blameworthy, we will add that 80 per cent of those who died without an operation had had a goiter from 8 to 30 years and, what seems even less credible, that 65 per cent of them had been toxic for more than one year.

These surely are figures which give all of us, physicians as well as patients, pause for thought. How is such a condition of affairs possible in an enlightened age, with the laity rather acutely aware of most of its own needs and the medical profession surely well trained? Mature thought along these lines has convinced us that there are two factors which stand out above all others in explaining this situation. In the first place, the thyroid patient is, as a rule, highly stimulated, and fails to sense her own need, or to regard herself as a sick person. In the second place, the physician at large is a highly com-

[1]Read before the Radiological Society of North America at the Seventeenth Annual Meeting, St. Louis, Nov. 30–Dec. 4, 1931.

placent individual when it comes to a study of this subject. One cannot otherwise envisage the policy of inaction or procrastination on the part of both patient and physician which leads to a situation such as that outlined above. If our figures mean anything, surely the patient and the doctor are playing with fire.

A further perusal of our records would indicate that the general practitioner does not recognize in toxic goiter any greater potential menace to the patient's health and life than he concedes to the general run of what he conceives to be surgical affections, among which appear many cases of hernia, varicose veins, hemorrhoids, ingrown toe nails, etc. We come to this conclusion because, for the past year, 42 per cent of our general surgery, exclusive of goiters, has been referred by practising physicians, whereas only 40 per cent of our goiters—with all their possibilities for disability and death—have been sent to us by physicians for treatment. This is almost incomprehensible to one who has seen 38 per cent of all the thyroid patients he has lost in six years die before they could be sufficiently rehabilitated for a surgical operation.

Let us continue with the results of our mortality studies as they were impressed upon us by the remaining 62 per cent, those who died following operation. Definite symptoms of toxicity had been present for over one year in this group. Of the patients dying after operation, death occurred in crisis, in afebrile circulatory failure, and from complications in about equal numbers. All of those dying in thyrotoxic crisis had been toxic for over 10 months, with one exception, and were, with one exception, under 50 years of age. Those dying in afebrile circulatory failure were, with one exception, over 50 and had had their goiters for periods ranging from 10 to 26 years; only one, however, had had toxic symptoms for more than six months. The circulatory systems of persons past middle life obviously stand poorly the added imposition of thyrotoxicosis. Again we are compelled, by a study of the patients who died following operation, as well as of those dying without it, to the conclusion that we were forced to receive these patients into a surgical service at a period of their illness when surgical treatment was attended by an unduly grave risk, one which we are hardly called upon to accept when confronted by the general run of patients.

The second question which we have undertaken to answer is, What sort of individual is the subject of thyrotoxicosis? If this is to be answered satisfactorily we must, we believe, look at the ailment as a phase of an existence into which it logically fits itself; in other words, the patient who presents herself with this malady was born possessing a potentiality which does not exist for the rest of us. If we may for a moment digress, the same line of reasoning must obtain for the rest of her life if a recurrence of the malady is to be prevented after we have succeeded in restoring her to health. The prime factors which would, in the light of our own experience, seem to merit consideration as causal factors are: (1) instability of the patient, (2) undue physical or mental stresses, and (3) presence of a pre-existing simple goiter.

The first of these three influences was brought out in no uncertain manner among the troops overseas in the late war. A certain degree of instability was easily overlooked. The young man went overseas where the stress, both emotional and physical, was beyond anything that troops had previously endured, with the result that thyrotoxicosis developed in a wholly unexpected percentage of cases. We believe our own figures, quoted above, are fairly representative of the fact that very many patients have been aware of a thyroid tumor long before the appearance of toxic symptoms.

The third question to be answered must regard the character of this malady. We must surely have a true understanding of its life history if we expect to combat it successfully. It must be fully understood that its course is marked by *remissions* which are to be regarded as *automatic* in character, though, of course, they may be influenced—and, indeed, precipitated—by certain forms of treatment to be detailed later. These remissions usually persist for some months after the patient has experienced an incapacity of a somewhat similar duration. It may be added, one regrets to admit, that a complete *restoration* to health, which is spontaneous in character—that is, a symptomatic cure—is exceedingly rare. In a wide experience extending over many years, we are absolutely certain of this having occurred in only one patient. Perhaps we may except those occasional "burned-out" sufferers who have managed somehow to exist through some ten (average) exacerbations, only to attain at last a permanent subthyroid state, accompanied by irreparable damage to the heart and parenchymatous organs. If *restoration* is to be brought about at all, it must be *constructive* in character as opposed to the remission which we have termed automatic; upon this consideration will be based our suggestions for treatment.

(One phase of the subject should not be passed over lightly, but the limits of this paper do not permit us to go deeply into it, namely, the diagnosis. There is a very considerable percentage of patients in whom it is most difficult to know whether we are dealing with thyrotoxicosis or some one of the many emotional or psychic conditions characterized by vascular and emotional instability and other phenomena which also characterize the thyrotoxic patient. We hoped at one time that the basal metabolism determination would help us out in this connection, but we will remind you once more that, during the remission, the basal metabolism may be quite within normal limits and this fact has led to confusion in diagnosis. However, these two classes of patients must be sharply separated unless disappointment and something like disgrace are to follow the removal of an enlarged thyroid for symptoms which have not been of thyrotoxic origin.)

The individual and not the disease is to be studied. With this in mind we are presenting quite briefly the nine criteria by which, in our own service at least, an attempt is made to estimate the severity of thyrotoxicosis and to formulate therapeutic indications in each patient who presents herself.

1. *Heredity.*—We can dismiss this matter with a mere statement that the ancestors of every individual determine to some extent the quality of tissue he brings into this world and the indefinite something which we will call (for want of a better term) his life expectancy.

2. *Age.*—Much observation in many hands has shown that the thyroid patient under 18 and the one over 50 years of age carry distinct handicaps with them. A surgeon feels that he cannot take away a relatively large percentage of thyroid tissue in childhood or early youth without interfering with growth, development, etc. On the other hand, he risks a high percentage of recurrence in these young patients by leaving too much thyroid tissue. The patient over 50 presents quite another sort of consideration, for she has not the physical reserve to meet *any* emergency in the same way she would have done on the sunny side of the half century mark.

3. *Duration.*—The long-continued existence in the toxic state tends, in the course of time, to bring about parenchymatous changes in all the organs, though the long-continued presence of the thyroid tumor itself may have meant very little in a mechanical sense.

4. *Circulation.*—The increased oxygen need, which characterizes thyrotoxicosis, is met in part by cardiac over-activity which leads, in the course of time, to something akin to the state that is suggested by the overworked race horse which has been pushed unmercifully in the last quarter until the point of exhaustion has been reached.

5. *Excretion.*—In this connection we refer in passing only to sweating, diarrhea, vomiting, bronchorrhea, and the changes in kidney function which are seen in the advanced stages of the disease. We realize, of course, that it is difficult to separate the rôles played by secretion and excretion in a study of this phase of the malady.

6. *Nutrition.*—No better evidence of thyrotoxicosis can be elicited than a history of rapid loss of weight, especially if accompanied by a ravenous appetite, provided, of course, that diabetes be excluded. However, this cannot always be done because the two maladies run concurrently more often than is supposed to be the case. It must be understood that nutritional decline is always to be regarded as involving one of the worst prognostic indications.

7. *Self-control.*—A partial or complete loss of self-control is to be regarded as very serious in every instance, and, when a true psychosis has developed in such a patient, the likelihood of a fatal outcome is much increased. This is especially true if anything of a surgical nature is undertaken.

8. *Metabolism.*—This index of the severity of the disease is too well known, we think, to justify us in any extended consideration of it, but it varies widely in each individual at different stages of the disease.

9. *Duration of Voluntary Apnea.*—In recent years, it has seemed to us that study of a patient's ability to hold her breath has given a criterion which teaches us more about the patient's vital reserve than does any other single one at our command. Indeed, it reflects something of that which is imparted by a study of three other criteria, namely, circulation, self-control, and basal metabolism. A preliminary report along these lines was presented by one of us, the junior author, to the American Society for the Study of Goiter at the Seattle meeting in July, 1930. The pearl-diver can hold his breath an unbelievably long time; Jackson and Lees, who examined 100 healthy students, found the duration of voluntary apnea to be 72 seconds after inspiration and 34 seconds after expiration; we find occasional strong men in whom it is 100 after inspiration and 50 after expiration. Contrast this with the lowest figures we have observed in a goiter patient who could hold her breath only five seconds after inspiration and an equal length of time after expiration. As a graphic portrayal of just what this means in thyroid surgery, we will say that in July, August, and September of this year we felt justified in doing thyroidectomy on the patients who entered the hospital with an average D.V.A. of 47/24, but nothing more than ligations on those who came in with an average D.V.A. of only 22/13.

The fourth question which we are asking ourselves is, What shall be done by our profession about the goiter problem? As we see it, experience forces upon us the following concept of the whole goiter matter. There must be, first, a considerable period, if the individual is very sick, for *rehabilitation,* the average duration of this period being about one year. This is succeeded by what may, for want of a better term, be called a *maintenance* period, which lasts as long as the patient lives and is devoted to maintaining an adequate level of health and prevention of recurrence. The rehabilitation period, so-called, consists of three phases. We formerly called the first one "preparation for operation" and the third one "after-treatment, immediate and remote," these two being separated from

one another by the second phase, a surgical procedure calculated to decrease greatly the amount of thyroid tissue. We do not now think it fair to the patient to separate these three phases of rehabilitation. We rather consider it essential to inform her when she is first seen that the rehabilitation is going to take a year and that the three phases of it are of about equal importance.

There are five measures at our command which shorten the first phase of rehabilitation during which the extremely sick individual improves to that point at which safe removal of the thyroid tissue can be contemplated. They are the use of (1) rest, (2) iodine, (3) radiation, (4) the injection of various substances, and (5) superior pole ligations.

It is impossible to state the exact value of any one or all of these five measures, since thyrotoxicosis is characterized by cycles in which a marked improvement appears periodically whether or not the patient is treated. It is only since we learned to do our operating in these periods of spontaneous or induced remission that the surgical mortality has approached a figure which justifies a continuance of thyroidectomy.

Our operative attack upon the gland should never be considered an emergency measure; on the other hand, if it is so employed, tragedies are very certain to be frequent. We are displaying a patient, Mrs. G., on whom we employed radiation in a way which may be novel to many. Hers was such a stubborn case that on Sept. 17, 1931, we cut flaps as for a thyroidectomy, completely exposed the anterior surface of the thyroid gland, and, with the wound open, gave her the following exposure: 5.5-inch spark gap, 3 ma., 1 mm. aluminum filter, 22-inch distance, 5 minutes. The layers covering the thyroid were completely restored and the wound healing was uneventful. We have not performed this on a second patient, preferring to wait six months to be sure that no permanent harm has been done to the parathyroids or other important structures in the field thus exposed. We were led to radiate the patient in the manner outlined because, after cutting flaps, her condition became such that a continuation of the operation seemed inadvisable. With the flaps opened, it was apparently possible to do more than is accomplished by radiation when the integrity of the skin has to be considered.

The third phase of rehabilitation, the after-treatment, terminates in many hands when the patient leaves the hospital. A very great deal is gained by continuing to observe and advise the patient until a year has elapsed from the time when she was first seen. In this way one avoids the many errors which are inevitable from a too early return to work or to the numberless other reactions which can mean harm for the patient who has nothing but her own inclinations and experience to guide her. The period of life maintenance is not one of strictly *medical* treatment, but should, rather, consist of occasional *supervision* on our part and of *co-operation* on the part of the patient. It is only by some such arrangement that recurrence is to be prevented in a certain small percentage of cases, variously stated by different authors as up to 6 per cent. We send our patients home with instructions to take a small amount of iodine, one to three drops of Lugol's solution each day, feeling that thyroid metabolism is rendered less arduous if we are justified in the assumption that a gland which finds its work easy is less likely than another to undergo a compensatory hypertrophy.

The observer who has traced many of these thyroid patients through the years following the operation has long since become convinced that their judgment about themselves is in many instances not to be trusted. These patients, more than any others, seem prone to the forms of indiscretion and immoderation which incline them toward a recurrence of their symptoms. They seem

often not to need a physician so much as they do need a custodian. Surely a judicious mixture of medical and custodial care is needed if these individuals are to remain healthy and useful after their period of rehabilitation is at an end.

CONCLUSION

It seems to us that there should be a complete understanding between the radiologist and the surgeon as to the field of usefulness of each in the treatment of goiter if they are to be mutually helpful in the highest degree to the patient. As we see it, there is involved absolutely no conflict of their interests. Each is more definitely useful than the other during a certain period of the goiter patient's treatment. Neither of them *cures* her; indeed, the word "cure" has not been used in this paper, advisedly, because the basis of the malady which we are discussing is unknown. What we do is to treat a syndrome and all we hope to accomplish is a certain *stabilization* of these patients which may, and should, remain permanent.

The period of usefulness which we, as surgeons, are definitely relinquishing to you, the radiologists, is coincident with the first stage of rehabilitation, that is, while we are trying to reduce thyrotoxicosis to the point at which surgery becomes safe. Radiation, during the period which we formerly called "preparation of the patient," is certainly not dangerous, and is surely efficacious at a time when the operative removal of thyroid tissue is absolutely dangerous. On the other hand, we would reserve for the surgeon the period which begins with the remission of symptoms. In other words, the thyrotoxic patient has passed through what may be broadly termed her crisis or at least her critical period, and has, with the aid of radiation, returned as nearly to the normal as may be possible with her gland in place. Then, and not until then, the removal of about nine-tenths or even more of her thyroid tissue transforms this temporary remission into a permanent restoration to her normal status, provided, of course, that the proper sort of follow-up is contemplated. This selective procedure may, we think, be termed one of a quantitative nature since the removal of half the thyroid (one lobe) does not accomplish at all the same thing. (Nothing would be more desirable from the patient's point of view than the development of radiologic or other treatment which would remove or destroy nine-tenths or more of the thyroid gland without at the same time imperiling parathyroids and other important structures, to say nothing of producing complete hypothyroidism. However, it would seem that mechanical removal, complicated as this procedure may seem when compared with radiation, must for the time being give the only promise of removing just the large proportion of thyroid tissue which is undesirable, and of leaving behind at the same time just the vastly lesser proportion which is indispensable to the continuance of the patient's health.)

From the foregoing it will appear that we do not consider either thyroidectomy or radiation the absolutely *vital* procedure in our treatment of thyrotoxicosis. Both are important within their own fields of usefulness. In the broadest sense, however, this is from first to last rather a problem of clinical management during a period which begins with the introduction of the patient to us and ends only when her measure of usefulness or, indeed, of existence is over. Does any radiologist wish to assume the sort of responsibility here involved? We think not. We hope not, at least, because we consider the radiologist far too useful a member of the medical profession in another capacity to permit him to employ his time in extended clinical pursuits.

THE SURGICAL TREATMENT OF THYROTOXICOSIS[1]

By H. M. RICHTER, M.D., CHICAGO, ILLINOIS

THERE can be but one purpose in discussing the surgical treatment of thyrotoxicosis before this Society—that of giving a basis for comparison with the radiologic treatment. In this way only is it possible to estimate the relative value of the two procedures. To begin, therefore, there must be a definition of the terms used; otherwise, there is likely to be much misunderstanding.

I shall confine myself to the subject of thyrotoxicosis, which is a toxemia, and entirely disregard the term "goiter," referring to mere enlargement of the thyroid gland, which is not of concern in this discussion. Since we are interested in a comparison of the results obtained by these two methods of treatment for thyrotoxicosis, our evidence must show: first, that the patients treated were really thyrotoxic, and, second, that the results of treatment are as stated and substantiated by adequate study.

A diagnosis of thyrotoxicosis can be made only after a personal study of the patient. It is evident that the status of the patient, when he first comes for treatment, can be determined only by means of personal, clinical, and laboratory examinations. In addition to the history and physical examination, laboratory tests give important diagnostic information. It seems equally evident that an estimate of the post-operative condition, that is, the results obtained by treatment, must depend equally upon skillful clinical and laboratory studies. Obviously, then, it is impossible to depend upon correspondence for furnishing the diagnostic information. Neither a report from the patient himself as to subjective symptoms, nor a report from the family physician concerning objective findings can be used as a basis for critical study. It is not true that the patient is the best judge of his own condition. His estimate is likely to be faulty and misleading, depending to a great extent upon his emotional make-up. An outstanding symptom of thyrotoxicosis is increased nervous irritability, a symptom present in many other disorders, and one which is quite likely to interfere with subjective observations of any sort.

The personal contact between physician and patient is of the greatest importance in clinical medicine. It is only through securing a complete anamnesis and by making a careful physical examination that an accurate diagnosis is possible. In addition, students of thyroid disease are practically agreed that repeated studies of the basal metabolic rate form another objective basis for judgment of the patient's condition. It naturally follows, therefore, that those who discuss thyrotoxicosis must be able to vouch for the clinical evidence and for the accuracy of the metabolism studies made on the patient.

The case reports which form the basis for this presentation are those of patients who were given this type of careful study. The majority of the metabolism tests were made by skilled technicians in my own laboratory. The remainder were made in laboratories for which I, personally, can vouch. All cases in which this type of data was not available were excluded from this study. To eliminate a possible source of error, cases are not included in which preoperative or post-operative metabolic or other data were obtained by correspondence with the patient or his physician. In comparing the results obtained by radiologic treatment of thyrotoxicosis with those ob-

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tained by surgery, it is necessary that you be equally as critical of your material. Patients concerning whom the statement is made, "They came with a diagnosis of thyrotoxicosis," whose metabolism studies were uncontrolled, or those who had no such studies, cannot be included in any scientific study without danger of error. Starting with these premises, we shall both be able to talk in exact figures. We can eliminate entirely such terms as "approximately" or "about" in making statistical statements.

In estimating the results obtained by treatment for any condition, the evidence obtained in the patients on whom the treatment was improperly carried out is not acceptable. In treating cancer with the X-ray, if the dosage is too small, the results will be less satisfactory. Inadequate resection of cancerous tissue gives equally poor results. And so it is with these two types of treatment for thyrotoxicosis. We must presume that your treatment is as satisfactory as it possibly can be, and that the surgical procedures undertaken are the most satisfactory type that can be employed. It is of no purpose to refer to experiences with patients who were inadequately treated.

Both radiologists and surgeons approach the subject of treatment for thyrotoxicosis from the same viewpoint, namely, that the source of the disease is in the pathologic thyroid gland. Both types of treatment are aimed toward reducing this thyroid activity.

It is my purpose to present the method of surgical treatment which I regard as necessary for obtaining satisfactory results and to give the results obtained by this method; then to compare these results with what the current literature has claimed for radiotherapy in the same disorder. If we start with the premise that the pathologic thyroid is the source of thyrotoxicosis, surgical treatment must aim at such radical removal as to bring the thyroid function within normal limits.

The normal thyroid, like most parenchymatous organs, has a large factor of safety. In other words, under normal conditions, its capacity to elaborate thyroxin far exceeds the needs of the body. As with other parenchymatous organs, the amount of thyroid secretion elaborated can be decreased by simple reduction of the mass of the gland. Irrespective of the degree of increased secretion that occurs in the pathologic state, adequate reduction of the mass of the gland will reduce the amount of secretion so that it will be within normal limits or may even be subnormal.

By using the basal metabolic rate as a measure of the activity of the pathologic thyroid gland, it is possible to control the activity of the gland with the accuracy of a laboratory experiment. While the basal metabolic rate may be normal, even though there is excessive thyroid tissue present, an increased metabolic rate can be present only when there is enough thyroid tissue in the body to produce it. It follows then that, when the metabolic rate fails to drop to, or below, normal following a thyroidectomy, the surgeon has left too much thyroid tissue in the body.

It is further evident that, when surgical treatment is employed, one cannot logically speak of a degree or percentage of cure of a thyrotoxic individual as measured by the metabolic rate. The patient is either cured or the operation is a failure. The surgical treatment is never a half-way measure; the patient cannot be 50 or 75 per cent cured. He must be 100 per cent cured or the operation is a failure. Adequate surgical removal of the thyroid gland must result in reduction of the metabolic rate to, or below, normal. The entire structure on which we base both surgical and radiologic treatment must fall to the ground if we admit of the possibility of a single exception to this statement.

Total removal of the thyroid gland is not

permissible. Some thyroid tissue must be left in the body. It has been suggested that this residual mass can, and often does, undergo hypertrophy and hyperplasia, with resultant failure of the operation and a recurrence of the symptoms of thyrotoxicosis.

It is impossible to use the terms "failure" and "relapse" interchangeably—they represent entirely different conditions. The failure of an operation is directly due to removal of insufficient thyroid tissue, and must be charged against the surgeon rather than against the principle involved. Although this failure is manifested by a continuation of the disease, the symptoms are less marked because there has been some reduction of the thyroid mass, but insufficient reduction.

Often the condition of the patient may be so improved that he regards himself as cured. A careful study, including metabolic rate studies, however, frequently will give ample evidence of continued intoxication. If careful post-operative studies are not made on these patients, they are likely to be included in the list of cures. Later on, when their symptoms again become more marked as a result of further hypertrophy and hyperplasia of the thyroid remnant, the conditions are regarded as "relapses." But "relapse" signifies only actual recurrence after a real cure of the thyrotoxicosis. This means that the treatment employed has brought the thyroid activity to normal. The patient's condition is normal for a time; then there is a return of the thyrotoxicosis as a result of growth of the thyroid mass left at operation. While such relapses are undoubtedly possible, in my experience they are exceedingly rare.

Careful studies show that many relapses, so reported, are simple failures caused by incomplete operation. The operation which I believe is indicated in the treatment of thyrotoxicosis is radical thyroidectomy—aiming at reducing the mass of thyroid tissue to the smallest amount which is compatible with normal or temporarily subnormal thyroid activity. In practice, this has proved to be about 2 grams of thyroid tissue —1 gram on each side of the trachea. In several hundred cases I have left less than this, and in about an equal number I have left from 3 to 4 grams, in an attempt to determine what amount should be left behind in order to produce a temporary hypothyroidism with a return to normal within a short period. I have been disturbed by having a number of patients remain hypothyroid for a year or more, due to my having left less than 2 grams of thyroid tissue. In view of these facts, I am now inclined to leave 2 grams or more in every case.

In a series of 1,235 consecutive patients in whom clinical examination and raised basal rates definitely showed the presence of thyrotoxicosis, I have performed the radical operation, aiming to leave from less than 2 to about 4 grams of thyroid tissue. I have been able to follow 1,096 cases for various periods:

Less than one year	195
One year	288
Two years	238
Three years	163
Four years	124
Five years	47
Over five years	41

In 159 patients, on one or more tests following operation, the metabolic readings were found to be above normal. The cause for the abnormal elevation was evident in all but a few of these patients. Nine were pregnant at the time the high readings were obtained. Ten had some type of infection, with elevated temperature. Thirteen were taking an excessive amount of desiccated thyroid. In five cases, basal conditions could not be obtained for psychic reasons. In two instances the cause for the high metabolic rates was not evident, and in two others the data were incomplete. In all, the

elevations were temporary, the final tests being normal (15 or below).

For varying periods 63 of the patients had elevated rates with a slow but steady drop to normal. It is my belief that more than enough thyroid tissue had been left at the time of operation. I am of the opinion that, in these cases, there is greater likelihood of so-called recurrence of the toxic symptoms.

Continued symptoms of thyrotoxicosis were evidenced by 39 of the patients. Of these, 23 consented to re-operation, which resulted in cure in 21, the basal rate dropping to normal or temporarily below normal. In the 21 patients who were re-operated upon, sufficient thyroid tissue was found present at the time of the second operation to account for the existence of the thyrotoxic symptoms. I also operated upon a considerable number of patients who had undergone elsewhere a primary operation for thyrotoxicosis. In all of these cases, also, sufficient thyroid tissue was present to account for the toxic symptoms.

At the time of the last study, 16 of the patients were thyrotoxic. In two of these, palpable masses of thyroid tissue were present in the neck some time after operation. In one patient the pyramidal process which was left at the time of operation underwent subsequent enlargement. In one patient a lobectomy was performed because one side of the gland seemed normal at the time of operation. In another case, since the patient was only 13 years old, more thyroid tissue was left than was customary.

In three of the 16 patients, normal basal metabolisms were present on two or more examinations, but after a material length of time, symptoms of thyrotoxicosis reappeared. These cases may properly be designated as "relapses." One of these was re-operated upon elsewhere. I performed a second operation on another of these patients and removed a mass of thyroid tissue weighing 15 grams, which was all found on one side of the trachea. On the other side, only a thin layer of tissue was noted. Following the second operation, recovery occurred rapidly. The metabolic rate was —3.4 per cent 37 days after operation.

To sum up, the results of surgical treatment in thyrotoxicosis in a series of 1,096 cases followed for various periods after operation, 1,057, or 96 per cent, became normal after one operation. Of the 39 patients who failed to become normal, 23 consented to re-operation. Of these, 21 were cured, as shown by return of the metabolic rate to or below normal. The incidence of ultimate success of radical operation for thyrotoxicosis is, then, 98.4 per cent. The incidence of failure, 1.6 per cent, is small. In view of the fact that in three of the cases palpable masses of thyroid tissue could be found after operation, and that in 21 re-operated upon masses of thyroid tissue were found, it is almost justifiable to account for all failures on the basis of faulty surgical technic and removal of insufficient thyroid tissue. The mortality in the series of 1,235 cases was 0.89 per cent. I wish to emphasize once more that, when failure occurs, it is due to leaving too much thyroid tissue at the time of operation.

There is one criticism which repeatedly has been applied to both the surgical and radiologic treatment of thyrotoxicosis, namely, that the removal of the thyroid gland does not eliminate the cause for the disease. The answer to this criticism, which adherents to both of these methods of treatment can give, is that, so far as has been shown, whatever the true source of the disease may be, the symptoms of thyrotoxicosis cannot persist when the activity of the thyroid gland is sufficiently reduced by operative or radiologic methods.

In comparing the results which I have obtained by radical thyroidectomy with those reported in the current literature for radiology, let me point out to you again that the diagnosis in all the cases included in my

series of patients is based upon personal study, including repeated studies of basal metabolism made under controlled conditions. The state following operation was regarded as necessitating as much study as the pre-operative condition. Cases on which personal studies could not be made were excluded. The radiologic literature, on the other hand, is lacking in the presentation of material that has received this same careful study. Ample experience has shown that the activity of the thyroid gland can be reduced to normal or brought below normal by radiotherapy, and this effect can be maintained. The question arises, then, Can such results be consistently obtained? Unless they can be consistently obtained, one must question the usefulness of this method of treatment.

In a review of the literature of the last five years, but one series of cases of thyrotoxicosis treated by the X-ray is presented in which the patients have been studied with any degree of accuracy. It is the series of 305 patients reported by Groover, Christie, and Merritt (1). In this report it is stated that 305 patients were treated and that 89 per cent of them were cured. The patients were studied for a number of years after treatment, and the gains in weight and improvement in the clinical symptoms are given as evidence of the value of the treatment employed. The pre-operative studies are not stated as having been controlled. The studies of basal metabolism apparently were not made by those who gave the treatment for the condition, and no metabolic data are given.

When the diagnosis is made by practitioners, the results of metabolism tests obtained from varied sources, and the treatment given by entirely different individuals from those who make the diagnosis, the value of the evidence is greatly reduced.

The first report made by Christie and his co-workers appeared in May, 1923 (2). The results of treatment on 114 patients were given and it was stated that 32 of them were cured. A second report (3) on these same 114 patients appeared in November, 1924, stating that 58 were cured. In other words, apparently some of the patients, at least, were under treatment for a period approximating 18 months. Obviously, when thyrotoxicosis persists for this length of time, permanent damage to the heart and other tissues of the body may result.

Jenkinson (4) presents his results in a series of cases treated by X-ray, 300 of which were observed for about four years after treatment. Although the results were apparently excellent, no data are given to permit the reader to draw his own conclusions.

The very foundation of any study purporting to demonstrate the value of any form of therapy must be: first, evidence that the diagnosis is correct; second, careful observations and personal study following the application of therapy to determine what have been the results.

It requires but little experience to realize that the diagnoses with which patients are referred to specialists are often remarkable for their inaccuracy. Too often the apparatus for obtaining a metabolic rate is advertised frankly for its value in increasing the doctor's income, and not often enough for its value in making accurate studies of metabolic disorders. Even data obtained by the better class of internists not specially interested in this type of work may be faulty because their technicians have had but little experience in making such tests. This type of work should be condemned.

In a series of cases reported by Pfahler (5), all types of goiter are grouped together. From the context of his paper, there appear to have been about 500 cases of thyrotoxicosis included. He states that in two-thirds of the cases good results were obtained with X-ray treatments, but here

again no data in the form of metabolism tests, or accurate analyses and descriptions of the clinical condition of the patients, are given.

A careful study of the German literature on the same subject has proved equally barren of that type of accurate, painstaking observations which are so characteristic of many of the German scientific investigations. None of the papers gives the results of detailed metabolic studies.

I need hardly say that I have the highest respect for the men whose work I have mentioned, but clinical research of this sort is open to criticism on the grounds stated. It must be granted that the mortality and complications of radiotherapy in thyrotoxicosis compare favorably with those of surgical treatment. Yet the apparent difference is not so great as it seems to be. The surgical mortality in those clinics in which a large number of thyroidectomies have been performed is in the neighborhood of 1 per cent, probably a little less than this. Competent surgeons, without special experience in thyroidectomy, may have an average mortality of about 2 per cent. Competent roentgenologists, in general, have a much lower immediate mortality. But what of the late mortality? The patients who are not completely relieved by radiotherapy—who have only temporary relief from their symptoms—continue to carry with them a pathologic thyroid gland. While the radiologic treatment does not produce immediate mortality, yet, with the continued thyrotoxicosis that is present in so many of the cases, there is further damage to the heart and nervous system, and marked shortening of the life expectancy.

There are but few statistical data as to length of life following either surgical or radiologic treatment. Christie's results are apparently satisfactory. A very accurate study of the goiter clinic of the Massachusetts General Hospital showed a remarkably high late mortality, although the total number of cases included in the study is too small to permit of any definite conclusion. My own late mortality is 26 late deaths following 1,235 thyroidectomies for thyrotoxicosis, distributed as follows:

One to six months	4 cases
Six months to one year	5 cases
One to two years	5 cases
Two to three years	3 cases
Three to five years	4 cases
Number of years not known	5 cases

I believe it reasonable to assume that the patient whose pathologic thyroid is removed has a longer life expectancy than the one whose thyroid is still present, even though his symptoms are less marked and his metabolic rate has been reduced.

SUMMARY

Radical thyroidectomy was performed upon 1,235 patients suffering from thyrotoxicosis. But few of these patients were not completely relieved of their symptoms by the operation. Re-operation was done upon 23, and, of these, 21 were relieved as shown by clinical symptoms and metabolism tests. One patient required a third operation to secure this result.

Three patients made normal recoveries and had two or more normal post-operative metabolism tests, to be followed by recurrence of thyrotoxicosis. These cases can be properly designated as "relapses." One of these was shown to be due to inadequate removal of thyroid tissue.

CONCLUSIONS

In the hands of competent surgeons, radical thyroidectomy seems to be the most satisfactory treatment for thyrotoxicosis. The evidence presented showing the value of radiologic treatment of thyroidectomy is faulty because of failure to present adequate pre-operative and post-operative studies of the patients treated. The immediate mortality with the radiologic treatment, while

low, is misleading in view of the shortening of life expectancy with the incomplete relief from the thyrotoxicosis which may occur in many of the cases.

REFERENCES

(1) GROOVER, T. A., and others: Roentgen Irradiation in the Treatment of Hyperthyroidism; Statistical Evaluation Based on 305 Cases. Jour. Am. Med. Assn., May 25, 1929, XCII, 1720-1734.

(2) CHRISTIE, A. C., MERRITT, E. A., and GROOVER, T. A.: Treatment of Hyperthyroidism by All Methods, with Summary of Authors' Experience with Roentgen Therapy. Am. Jour. Roentgenol. and Rad. Ther., May, 1923, X, 385-393.

(3) IDEM: Roentgen-ray Treatment of Hyperthyroidism. Jour. Am. Med. Assn., Nov. 29, 1924, LXXXIII, 1757-1761.

(4) JENKINSON, E. L.: Illinois Med. Jour., January, 1927, LI, 56-62.

(5) PFAHLER, G. E.: Roentgen-ray Treatment of Goiter and Hyperthyroidism. Proc. Connecticut Med. Soc., 1929, CXXXVII, 202-213.

New Radium Discoveries Made in Canadian Northwest.—Two new rich radium-bearing ore veins were discovered at Great Bear Lake, in northwest Canada, just before the winter freeze-up stopped further prospecting, Hugh S. Spence, Canadian Department of Mines expert, has stated at conferences with Washington geologists. Mr. Spence as official visitor to the radium strike in Northwest Territories himself aided in the discovery of the new bodies of pitchblende ore.

Earlier reports of the rich finds of Gilbert LaBine, discoverer of the original radium ore deposits, were authenticated by Mr. Spence, who says:

"Beyond any question the pitchblende deposits at LaBine Point constitute a very valuable source of radium. At the present value of radium, ore could easily meet the $400 per ton cost of shipment to the railroad."

More and larger amounts of pitchblende than yet found, containing, at present prices, from $6,000 to $8,000 worth of radium to the ton, may yet remain to be discovered, Mr. Spence predicted. Two of the veins have been traced for distances of 1,400 and 2,500 feet, respectively, and all four seem to run together like the fingers of an outspread hand. A still larger and more valuable deposit, he said, may lie at the "wrist," somewhere to the northeast of the present workings.

Another new strike of the precious pitchblende, twelve miles distant from Echo Bay where the first vein of LaBine's Eldorado Gold Mines, Limited, was located, has already been reported on the ground of the rival Northern Aerial Minerals Exploration Company.

Planes were arriving during all the time of his stay at LaBine Point on the Great Bear Lake, Mr. Spence said. These were carrying prospectors on the look-out for further silver deposits. LaBine's No. 2 pitchblende vein, interlaced with valuable native silver veins, the best so far discovered in the region, assaying some 9,000 ounces to the ton, had roused the hopes of these adventurers.

Only two men were on the ground at the time of Mr. Spence's visit, because of the freeze-up, but mining operations were to be resumed. Fourteen surface pits were being worked in the Summer of 1931. The ore obtained from these by hand picking averaged 50 per cent uranium oxide, or about one gram of radium to eight tons of ore.—*Science Service.*

THE MEDICAL ASPECT OF THYROTOXICOSIS[1]

By CHARLES ELLIOTT, M.D., CHICAGO, ILLINOIS

THE general practitioner, through lack of opportunity to study thyroid diseases *en masse*, is frequently misled in the interpretation of symptoms referable to the thyroid. The patient who early seeks relief at the hands of his family physician may, consequently, lose valuable time before his complaint is accurately appraised and adequate remedial measures applied.

Indeed, even those especially interested in the study of thyroid disease encounter many perplexing clinical problems in the recognition of hyperthyroidism when it presents itself under one of its less frequently encountered, although none the less characteristic, clinical types.

Needless to say, in a disease process the manifestations of which are so closely bound up with the personality of the patient, it is often difficult, at times even impossible, to form an opinion as to the true status of the patient without long-continued observation and consideration.

The family physician or the general medical consultant occupies a strategic position in this respect, especially if he has a thorough knowledge of the personality and responsibi'ities of the patient. If, in addition, he has a comprehensive knowledge of the possibilities as far as hyperthyroidism is concerned, his advice is invaluable.

Much confusion results in the evaluation of symptoms commonly attributed to thyroid disease but induced as well by other processes in which the thyroid gland may also be concerned.

The thyroid gland is an important organ in health and from that viewpoint may be considered a gland of efficiency. It plays an important part in determining the bodily reaction to mental and physical stimuli. However, it does not act singly in this respect, but rather in conjunction with other vital forces in the body, including the other ductless glands and the sympathetic nervous system.

Among those about us we recognize the dull, stupid, and unsuccessful; the alert, mentally keen, and successful, and the overstimulated, unbalanced, rarely successful individuals as representing varying grades of individual efficiency—dependent largely, as we now understand it, upon the maintenance of a functional balance of the many forces in the body, including the anatomic nervous mechanism. In all such adjustments, the thyroid gland plays a major rôle.

The normal individual who, through no fault of his own, is forced to superhuman effort in providing support for his dependents during this period of economic depression and unemployment, or the constitutionally unfit individual who assumes little or no responsibility even in normal times, may find himself worried, anxious, nervous, tremulous, sleepless, with cold, clammy, cyanotic extremities. He may complain of precordial pain, palpitation, tachycardia, weakness, and loss of weight—symptoms commonly seen in thyroid disease but manifestly not due to disease of the thyroid itself. The exact reaction picture varies with each individual and represents the unsuccessful mental and physical adjustments of that particular individual to his environment. We speak of this condition as "effort syndrome" or "anxiety neurosis."

Every individual has a limit of endurance beyond which he cannot go without manifesting symptoms similar to those enumerated. It matters not whether these responsibilities are voluntarily assumed or imposed by force of circumstances.

Our Government unwisely drafted men

[1]Read before the Radiological Society of North America at the Seventeenth Annual Meeting, St. Louis, Mo., Nov. 30–Dec. 4, 1932.

from all walks of life to fill the ranks of the American Army during the World War, regardless of their mental fitness to assume military duties. As a result, the Veterans' Bureau hospitals to-day are filled with these maladjusted and unfit men, some of whom were previously able to adjust themselves, at least to the extent of self-support, but who now look to the Government for support of themselves, if not their families. It is difficult for them to realize that the war had little, if anything, to do with their present unhappy status. England, more experienced, excluded misfit recruits at the beginning of the draft.

The symptoms thus induced in the presence of a normal thyroid gland are none the less thyroid symptoms when this term is employed in the broadest sense, including associated ductless gland imbalance and disturbance of the sympathetic nervous mechanism.

We speak glibly of the symptoms of infectious diseases as being directly due to the invading organisms, whereas a little reflection must convince us that it is not the bacterial invasion, *per se,* but rather the reaction of the body as a whole to the infection which is directly responsible for the symptoms.

For example, weakness, loss of weight, tachycardia, fever, flushing, sweating, and increased basal metabolic rate, in addition to local findings in the lungs characteristic of incipient pulmonary tuberculosis, are not due directly to the tuberculous invasion but rather to the reaction of the body as a whole to the bacterial attack. The symptoms enumerated are none the less thyroid symptoms because they are observed in association with an infectious disease.

The symptoms of such conditions as effort syndrome or chronic infections may so closely simulate hyperthyroidism as to be indistinguishable from those due to disease of the thyroid itself. In fact, no hard and fast line may be drawn between the two, and often enough men experienced in the study of hyperthyroidism may not be convinced as to the exact status of an individual patient even after long observation.

It is obvious that therapeutic measures directed at the control of hyperthyroidism in such patients—that is, those in whom hyperthyroidism may be simulated but in reality does not exist—can result only in therapeutic failure and bring discredit to the particular type of therapy employed.

The difficulty, of course, is one of mistaken diagnosis and it should be charged to the internist. In his defense, however, it must be recognized that no absolute rules can be laid down which unequivocally separate the manifestations of a latent infection, an anxiety state, or a beginning or low-grade hyperthyroidism. A safe rule is to defer any therapeutic attack on the thyroid, surgical or otherwise, or indeed even the use of iodine, until the diagnosis is established beyond any doubt.

A third group, which at times offers great difficulty in recognition, is the so-called thyrocardiac group. Included in this group are patients with cardiovascular manifestations not unlike those seen in other forms of heart disease but in which the usual manifestation of hyperthyroidism—the underlying cause of cardiac disability—is either obscure or entirely overlooked.

The hyperthyroid symptoms are those of long-continued, although low-grade, toxic adenoma. In contrast to the usual heart case, these patients are nervous, alert, often tremulous, with warm, moist, pigmented skin, and often eye signs of exophthalmic goiter. Thyroid enlargement may be lacking; glycosuria, when present, is significant.

The basal metabolic rate is increased. A rate of plus 30 or even less, in the presence of heart disease, would be distinctive, since an increased basal metabolic rate is, I believe, not a feature of heart disease, *per se.*

The heart withstands the drive of long-continued, low-grade hyperthyroidism remarkably well. Often many years may elapse without enlargement. The heart tones are loud and quick; a systolic murmur is often present; hypertension may have been present for years. Later, myocardial degeneration results and enlargement occurs; the apex is found to the left rather than down. Various types of arhythmia, particularly auricular fibrillation, may be present.

It is characteristic of the thyroid heart that it responds indifferently to digitalis but often surprisingly well to digitalis and iodine. Usually the diagnosis is delayed for years and therapeutic measures designed to control hyperthyroidism are rarely employed until after much damage has been done.

A fourth group, presenting difficulties in diagnosis, is that of hyperthyroid patients who are under partial iodine control. Iodine causes a reversal of the hyperplastic gland toward the colloid or resting state, and a more or less complete, although usually temporary, arrest of symptoms.

Iodine is used to prevent simple goiter and may be administered with good effect in all clinical types of hyperthyroidism. It acts almost as a specific, and, when administered in sufficient amounts in the control of hyperthyroid crises, it may save lives. It is, therefore, a most valuable drug to use in the control of thyroid disease.

All this is known to the general practitioner who is not averse to administering such a harmless yet potent drug to those of his patients who (he suspects) may have hyperthyroidism. His attitude is one of willingness to try iodine in doubtful cases, hoping for beneficial results.

This attitude is fallacious only insofar as it applies to the administration of iodine to patients with exophthalmic goiter in whom iodine causes a marked, although temporary, remission of symptoms. This type of goiter, however, continues in spite of iodine therapy, and much valuable time is lost. As complete a remission probably cannot be accomplished by the administration of iodine at any subsequent period.

When patients under partial iodine control are first seen by a consultant, it may be quite impossible for him to form any opinion as to the patient's thyroid status. Much confusion, therefore, results. Iodine therapy should, I believe, be deferred in all cases of goiter until a positive diagnosis is made and a plan of treatment adopted. This must not be construed to indicate that iodine administration should be delayed even for an hour in the treatment of hyperthyroid crises.

Hyperthyroid crises present many difficulties in diagnosis for the general practitioner. While it is true that these patients may have had a known hyperthyroidism of some degree for years, yet the sudden onset of violent thermal, cerebral, cardiac, or gastro-intestinal manifestations in various combinations, apparently dependent, at least to some extent, upon the individual reaction of the patient, is a very serious matter indeed. Severe general infection, encephalitis, cardiac failure, or an acute surgical abdomen may be simulated. Occasionally patients in a hyperthyroid crisis, with predominant gastro-intestinal symptoms, are rushed to the hospital for abdominal section.

The diagnosis must depend upon the detection of hyperthyroidism as the background of the acute and critical manifestations. It is often difficult, if not impossible, to get a satisfactory basal metabolic rate reading in these patients during the period of crisis. The correct interpretation of such manifestations is, of course, of crucial importance to the patient, for instance, in preventing abdominal exploration and insuring the administration of large doses of iodine by mouth.

Under standard treatment the crisis will

soon pass and treatment of the underlying hyperthyroidism may proceed as usual.

Needless to say, no patient should be subjected to therapeutic measures directed toward the modifying of thyroid activity unless the physician has, first, a clear-cut conception as to what part, if any, the thyroid may play in the production of symptoms.

River Improved to Bring Radium Ores to Civilization.—Eight hundred miles of waterway linking rich radium discoveries with civilization are being improved by the Hudson Bay Company in order that valuable ores newly discovered in the Canadian Northwest Territories can be transported out of the wilderness.

The radium ores are worth $70,000 a ton at present prices and silver ores found in the same workings assay $3,000 a ton.

Airplanes have been used to carry prospectors and miners back and forth, but it will be more economical to carry the heavy ore by water. Twenty tons of ore were brought out last Summer, but the difficulties were great.

Most of the improvements are being made on the Great Bear River, the outlet from Great Bear Lake, on which are situated the new mines. The Great Bear River leads to the Mackenzie, down which some 7,000 tons of freight are carried in the fur steamers each year. One ten-ton scow is the only means of transport at present on Great Bear Lake itself. —*Science Service.*

X-RAY TREATMENT IN GOITER ILLNESS[1]

WITH RESULTS REPORTED AND COMMENTS MADE ON 200 INDIVIDUALLY CONTROLLED CASES

By ALDEN H. WILLIAMS, M.D., F.A.C.P., Grand Rapids, Michigan

THE literature on hyperthyroidism and the thyropathies presents a wide variation of opinion. The cause of goiter illness, accepted by many, is abnormal activity of the thyroid cells. Emphasis on autonomic imbalance, as a factor, is made by a goodly number. The belief that one is predisposed to the illness by a lack of iodine is quite generally accepted, but some think calcium excess is a predisposing cause, and iodine deficiency of minor importance. We are told that iodine benefits both toxic adenoma and exophthalmic goiter. Then again we are informed that iodine is of no value in toxic adenoma. Some good authorities state that there are no contraindications to surgery; others say this idea is very much open to question. In the one opinion, radiation therapy is temporizing, and curative in the other. The cause of goiter illness begins in the thyroid or elsewhere, subsequently upsetting the thyroid. Goiter histopathology is, or is not, consistent with symptom complex. The thymus has, or has not, anything to do with the disease. Graves' disease and toxic goiter are described as different diseases, or the same disease in different stages, or the same disease with different constitutional sensitivities. Writers emphasize the immediate dramatic cure of symptoms by surgery—others question the cure by reporting a large percentage of sick patients a year or more later. Some institutions emphasize immediate low operative mortality, with recurrences given repeated subtotals and kept out of the morbidity statistics as long as possible.

A well-known neurologist reviewed a group of over a hundred thyroidectomies and reported myxedema symptoms in over 20 per cent of the cases two years after operation. An internist states, in his book on the nonsurgical treatment of goiter, that 30 per cent of the cases that enter his institution for treatment come with a thyroid scar.

All of this contradiction opens a fertile domain for the radiologist to appraise and lures him to chart, in his own field, a course that may lead to a clearer conviction of the successful treatment and end-results.

HYPERTHYROIDISM

Although the exact etiology of hyperthyroidism is not known, it is most probable that thyroid cell activity is an important factor in the cause. If all thyroid cells are removed, normal body activity is crippled.

Surgical, medical, or radiation management modify the clinical picture of hyperthyroidism. If we are treating goiter illness by one method and know nothing of the problem of other methods, we should feel a sense of inadequacy and bewilderment.

Accepting then, as a working hypothesis, that goiter illness, known in some of its variations as hyperthyroidism, toxic goiter, and exophthalmic goiter, is caused by excessive or altered secretion of the thyroid gland, we may expect methods which inhibit or destroy function to be curative.

RADIATION TREATMENT

As agents, surgery and radiation have much in common: both abolish function in a subtotal degree. Results seem to be very similar in cure statistics. It is said that

[1]Read before the Radiological Society of North America, at the Seventeenth Annual Meeting, at St. Louis, Missouri, Nov. 30–Dec. 4, 1931.

either method will cure from 50 to 75 per cent of all cases and produce satisfying improvement in from 15 to 25 per cent more.

In this study, I do not wish to set up one method against the other, but to give my own experience of radiation management, and some few comments based upon my observation and survey of surgical treatment, which may broaden the judgment and appraisal of both methods. My hope is that, as time goes on and further work is done in all fields, the accumulation of cases, by tolerant and sympathetic collaboration, will reconcile differences and balance the elements of the problem. As the radiologist views this problem, he regrets that in some books, and at some goiter conferences on the general consideration of treatment of thyroid disease, so little space is given to the method of irradiation.

The aim of any treatment is the cure as soon, as permanently, and as surely as possible, and while doing it, to give the patient as much comfort and activity and safety as available.

I have been interested in the radiation treatment of thyropaths for 15 years. The longer I have watched results and the more I have followed reports of other methods, the more courage I have accumulated to make this report.

GROUP MATERIAL

In discussing material, it seems impossible to avoid the subject of classification. All of the 200 cases may go, if we wish, under the inclusive class of hyperthyroidism, with decision based upon carefully checked elevated basal metabolism. As in the usual report, subdivisions of toxic goiter and exophthalmic goiter have been arbitrarily made upon consideration of age, onset, symptoms, and physical examination.

The material (Table I) is consecutive and unselected except that, instead of using a larger group of 258 cases, some of which were incomplete, I did elect to throw out 48 cases deficient in preliminary examination, basal data, pulse, weight, progress notes,

TABLE I.—CLASSIFICATION OF PATIENTS TREATED

Per cent	Number	
52	104	Hyperthyroidism
28	56	Toxic goiter
17	34	Exophthalmic goiter
3	6	Post-operation recurrences
22.5	45	Male
77.5	155	Female
31.5	63	Under 30 years of age
68.5	138	Over 30 years of age
22	44	Duration of previous symptoms—under 6 months
78	156	Duration of previous symptoms—6 months to 15 years
8	16	Mild illness
55	110	Moderately severe
37	74	Very severe
35	170	Cases from rural Michigan
65	130	Cases from city of Grand Rapids
100	200	Number of cases in group

Average time since treatment—three and one-half years

and follow-up records. Some of these incomplete cases may be good for later study. Cases of simple thyroid enlargement, without symptoms of illness, are not here considered. They may be relegated to a prophylactic study or to cosmetic surgical therapy.

There were so many borderline and atypical and mixed cases that I did not feel comfortable in classifying them in definite groups. I realize my consideration of the 200 cases generalized as *goiter illness* is also open to some question. A few cases were errors in diagnosis in which treatment was started for hyperthyroidism, which may not have been present. They were disguised cases and did not check true as we went along, treatment being early discontinued with less harm, I hope, to the patient than might have followed had the error been an operation.

A few other cases were thrown out because of abortive treatment brought about by change of mind of the patient, pressure of neighbors, or decision of the surgeon that operation was imperative.

In comparing statistics of cure given by different radiotherapeutists, one is puzzled by the great divergence of claims. This may be explained possibly by the different types of thyroid illness and the varied severity found in different localities.

EXOPHTHALMIC TYPE

In our group of 200, there were 34 cases clinically of the *exophthalmic type* (Figs. 1-*A*, 1-*B*).

Cured, $70^{30}/_{34}$ per cent.

Improved, $17^{22}/_{34}$ per cent.

Unimproved, $11^{16}/_{34}$ per cent.

This tabulation compares favorably with the cure analysis of the whole group.

The four failures show the following human documents which are recognized because of familiarity:

1. Socially inclined—persisted in parties and nightly movies. There was no improvement after four treatments, and the patient was sent to operation.

2. The patient, who would not have his abscessed teeth extracted, was told not to return until this had been done (did not come back).

3. This patient is the busy proprietor of a store and insists on fishing and hunting. He will not accept his limitations and is still not well.

4. In this case, there is some emotional conflict, disharmony at home. The patient needs a neuropsychiatrist. Diagnosis is clouded.

Of the six improved cases, two suggested neurasthenic possibility, being worse in the morning and at no time very ill.

In the 24 exophthalmic cures (Fig. 2) were some of our most desperate cases, and brilliant results; among them were three extreme mental cases of the confused type which became normal and have remained so over the three-year period of our follow-up study.

Perhaps in thyroid illness, all statistics should use the word "rehabilitation" instead of "cure," and yet, if the patients are relieved of all symptoms upon which was

TABLE II.—TREATMENT AVERAGES: 200 CASES

Average number of treatments per case	10.74
Average time (in months) over which treatments were given	3.65
Average weight at beginning of treatment—per case	124.4
Average weight gain—per case (165 cases)	8
Average weight loss—per case (29 cases) (6 cases showed neither gain nor loss)	4.30
Average pulse rate at beginning of treatment	105
Average pulse rate at end of treatment	84.5
Average lowering of pulse rate (181 cases)	24.2
Average increase of pulse rate (17 cases) (2 cases showed neither gain nor loss)	8.5
Average basal metabolism at beginning of treatment (117 cases)	+49
Average basal metabolism at end of treatment (108 cases)	+16
Average time (in weeks) before improvement commenced	3.3

based the diagnosis of goiter illness, why are they not cured?

In looking over this exophthalmic group, we recognize the controversy aimed at both surgical and roentgen treatment. Without results to back us up, it might seem illogical to treat or remove surgically an emotionally activated thyroid when a causative mental conflict remains. Possibly we are reversing the rotation of a vicious circle by lessening the hyperthyroidism, which diminishes sensitivity and nullifies the conflict. This lessened conflict, having a diminished stimulation on the thyroid, pyramids the benefit.

Fig. 1-*A (left)*. A patient presenting the exophthalmic type of goiter. Before treatment, the weight was 110 pounds, pulse 120, and the basal metabolic rate + 50.

Fig. 1-*B (right)*. Same patient as shown in Figure 1-*A*, after treatment. The weight was 133 pounds, pulse 84, basal metabolic rate + 15.

In this exophthalmic group, we made a special effort to take plenty of time with quiet visits and personal questioning. The cases seem to be practically unanimous in suggesting a neuropathic personality. They are vacillating in confidence and need to be frequently realigned and reassured. This is the point at which we failed in the cases that gave up treatment and went to operation, even when they were improving.

One radiologist advocates treating by X-radiation only those cases which, by personal conviction, prefer irradiation. I would say if we, ourselves, have a firm belief that a line of treatment is indicated as best and safest, it would seem part of our duty to spread this belief before such a patient if necessary, and to have no lack of courage in commencing and continuing treatment.

The surprising triumph in many cases is not only the change in appearance and personality, but in the confidence toward the treatment as time goes on. Patients be-

come easier to influence and more logical to manage.

HYPERTHYROID GROUP

In the hyperthyroid (Fig. 3) group of 104 cases, there were 10 adolescent goiters with increased pulse and basal rate, as the main excuse for treatment. These received an average of four treatments, before becoming normal.

One young girl in this group, who exhibited no imperative symptoms and had a basal metabolism under +20, went to operation two days after our initial treatment. I saw her a year later, with marked symptoms of subthyroid ill-health. A surgeon has no excuse for a hurried diagnosis, for he knows his thyroidectomy is irrevocable.

The number of cases classified as toxic goiter (Fig. 4) made a group of 56, with an average long history of previous attacks and recent flare-ups. These cases represent chronic illness in the later decades of life with variable visceral damage. That is why no quick cure in this type should be expected.

TREATMENT AVERAGES

The average time for the appearance of improvement in symptoms was three weeks, or after the third treatment. This explains why the Holmes group were disappointed in radiation therapy. They arbitrarily made their decision to give three treatments and, if no improvement was apparent, to refer the case to the surgeon. This is like advising roentgen treatment only in pre-surgical cases.

There were several cases with discouragingly long durations of symptoms and treatment, four cases receiving over 25 treatments in seven months, but with complete recovery, and no over-treatment residue.

Treatment is discontinued if the basal rate is near +15 and the weight has increased and the pulse returned to normal.

Of the cases that came to us for irradiation, 3 per cent were post-operative recurrences. Israel Bram, of Philadelphia, reports that 30 per cent of the cases coming to his institution are post-operative.

We reported one of our six post-operative recurrences as a radiation failure. It is a questionable point to decide that the final effort in the case shall assume the entire odium of failure, or flaunt the full credit of success.

We radiologists see the surgeon's failures and he sees ours, and the medical man sees both. Refractory cases in any field need co-operation, and the collaboration of all methods of treatment. One surgeon states that any treatment other than operation is contra-indicated in goiter, because of delay and malignancy possibility.

Carcinoma developed in two of our cases, or 1 per cent.

I have tried to understand the apparent hostility of surgical organizations to other than operative management. I cannot feel that it is imaginary on my part, or, on their part, instinctive competitive guarding of their own field. Radiologists are seldom placed on programs by surgical organizations to discuss their experiences in treating goiter. It may be the surgeon's lack of understanding of radiation treatment and its results, or a natural suspicion of the new, untried, and unknown.

SOURCE OF PATIENTS

Our group had a larger percentage of toxic goiter type than the usual group reported. In trying to analyze this, I find that the greater number of these cases were not referred by physicians or surgeons, while, on the other hand, the majority of the exophthalmic type were cases which had been referred. The roentgen therapist, consequently, is limited in cases referred to him by the decision of his medical and surgical colleagues—that toxic goiter *is* surgical.

This limitation and clipping of wings is especially true of the full-time salaried hospital radiologist. Hospitals are usually surgical, and in them, instead of the internist be-

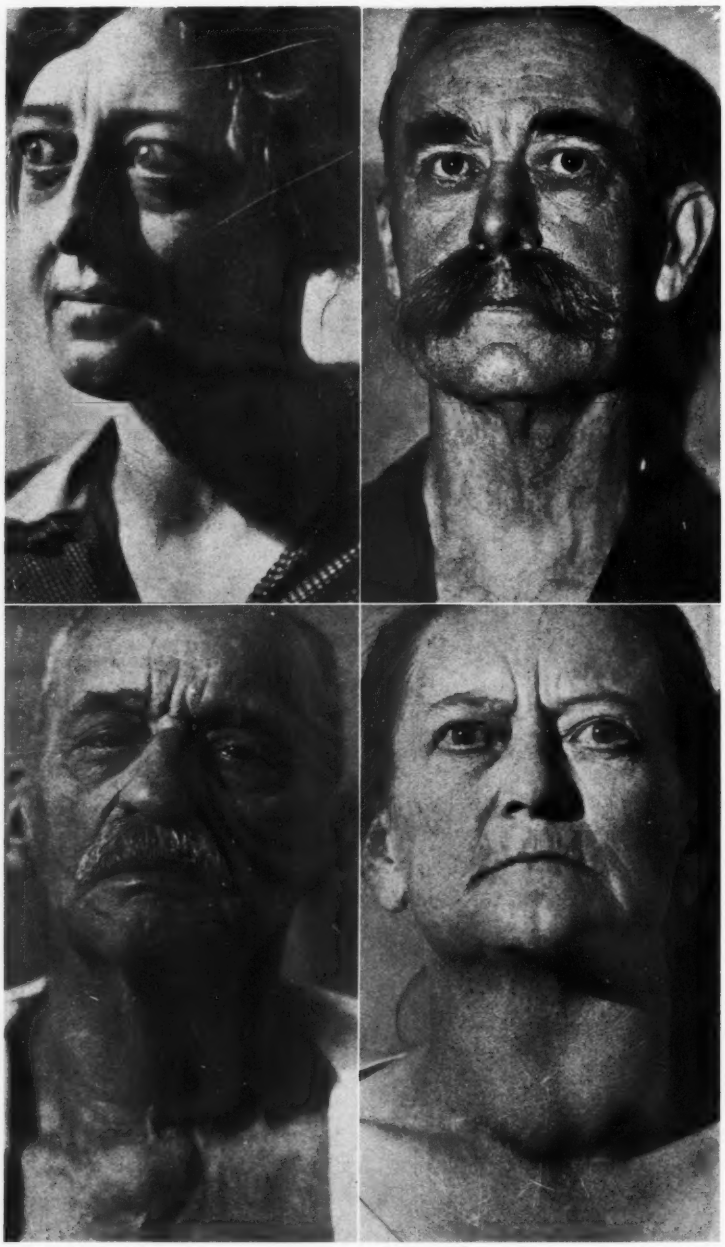

Fig. 2 *(upper left)*. A typical member of the exophthalmic group.
Fig. 3 *(upper right)*. A patient suffering from hyperthyroidism.
Fig. 4 *(lower left)*. A member of the toxic goiter group.
Fig. 5 (*lower right*). A case of toxic adenoma, recurrent after operation.

ing judge as to the proper treatment régime to be carried out, the surgeon holds dominion over all.

To cloud the issue spontaneous recovery has been suggested as a factor in the radiologic cure, but it seems to me too rare in a mixed group of patients with thyroid illness to be accepted. Improvement under radiation treatment is too uniform to be considered spontaneous. Non-treated, or scientifically neglected cases, do not have a parallel cure percentage.

WEIGHT

The weight gain, as noted often by others, was the best guide to a decision of improvement. Patients who have had a great loss of weight before beginning treatment may be expected to gain the most before being cured. We report an average gain in 165 cases of eight pounds; a loss in 29 cases of 4.3 pounds, with no weight changes in six cases.

PULSE

The pulse, which, too, is a fairly dependable symptom for diagnostic decision, is also a good calibration of improvement. We report a beginning average pulse rate of 105 in the 200 cases; a decrease of 24.2 beats in 181 cases during treatment; 17 cases showed an average increase of 8.5 beats, and two cases showed neither gain nor loss. The almost uniform improvement of pulse rate during treatment is significant and gives one the comforting feeling that some change for the better is going on.

DURATION OF TREATMENT

The number of treatments required varied, ranging from four to 29 over a period of from six weeks to 10 months. The average number of treatments per case in our group of 200 was 10.74, and the average time under treatment was 3.65 months.

In studying alone the 74 more severe cases in the group, I find that there were 82 per cent which became well and stayed well for the average of the 4.6 years follow-up period to date. So it would seem that in the group of the worst cases may be found the most striking indication for roentgen treatment.

BASAL METABOLISM

We feel that the basal metabolism is so important as a valuable link in doubtful cases, and as a quantitative element in progress of treatment, that we have thrown out of our study all cases having incomplete basal records. This has left consideration of a smaller group, but I think it has given a greater confidence in possible conclusions.

Basal reports are by no means infallible. One should bear in mind that rapidity of breathing alone raises the basal reading. Remember, also, that the rate has a different meaning, whether the case is spent or on the up-grade. One should own a metabolimeter and know its calibration and peculiarities after many normal clinical checks. One should make the test himself, if in any doubt of the tact and experience of the assistant or technician, and never fail to inquire into the deportment of the patient during the 12 hours preceding the test. One may find that a small cup of coffee, or a bit of toast, or a long walk has been indulged in.

The average basal metabolism of 200 cases at the beginning of treatment was +49; at the end of treatment, +16, showing a grade and constancy of reduction too uniform to be assigned to any predominating cause other than radiation treatment itself.

RECURRENCES

We had eight cases which recurred after one year, or 4 per cent. I must admit here

TABLE III.—TREATMENT RESULT

Per cent	Number	
100	200	Cases studied averaging 3½ years since radiation treatment
80.5	161	Cured
13.5	27	Improved
6	12	Unimproved
4	8	Recurred after one year
2.5	5	Went to operation
0.5	2	Developed myxedema
0.5	1	Developed telangiectasia

TABLE IV.—MISCELLANEOUS OBSERVATION IN GROUP MATERIAL OF 200 CASES

Per cent	Number	
26	52	Emphasizing focal infection factor
18.5	37	Emphasizing overwork as possible factor
13	26	Emphasizing fear and worry as possible factors
9	18	Emphasizing family disharmony as possible factor
18.5	37	Showing gastro-intestinal symptoms
15	30	Showing subjective heart symptoms
6.5	13	Showing hypertension
6	12	Showing severe heart damage
4	8	Associated with fibroid
4	8	Associated with marked mental symptoms
3.5	7	Associated with low grade fever
2	4	Associated with diabetes
1.5	3	Associated with persistent hoarseness
1	2	Associated with carcinoma in thyroid
	200	Group material

that on re-study I removed three cases from the relapse statistics because their secondary rise of symptoms occurred a few months after treatment and within the year usually allowed for cure. In these three cases, the pulse and basal rate showed the treatment was not sufficient when it was interrupted. Recurrent cases usually respond readily to a further short course of treatment.

Recurrence is a characteristic of thyroid illness (Fig. 5) and should not worry the reporter of thyroid statistics. Nor should the therapist view it with unusual concern, for a few more radiation doses will usually bring on permanent recovery.

At the Interstate Convention in October, Dr. Frank Howard Lahey, of Boston, said: "If my patient does not get well, I know I have not taken out enough thyroid." Thus could the radiologist say, if he wished: "I failed in that case because I did not give enough treatment. The failure is not in the method of irradiation, but in my deficient technic." Our failures were 12 cases, our improved cases numbered 27, and our cures totaled 161 (Table III).

It is satisfying to feel that patients cured by radiation still have a thyroid gland left in case the body needs it for future endocrine balance. The gland has not been destroyed, but more or less inhibited according to need.

TECHNIC

Our roentgen technic has changed only in a minor degree in the last 10 years. In the usual cases the factors are 125 K.V.P., 36 cm. F.S.D., 3 mm. aluminum filter, 5 ma. current, one area 10×12 centimeters. The dose is repeated weekly, or at 10-day intervals, for an average of 10 doses.

The factors which are changed slightly, as the case suggests, are focal skin distance and increased fields in large goiters. The time is decreased in sick and hypersensitive cases. The spacing of treatments is extended in mild cases. The number of treatments is cut down, if improvement starts early.

In stubborn cases, we do not change the factors, but have no fear in extending the number of treatments over a period of from six to seven months.

We aim to give from a 40 to 55 per cent erythema dose. As is known, this would vary the time factor in different equipments. One should get his own so-called erythema dose by skin test and then measure the same dose in r units, so that technic may be duplicated. We have two machines which, checked by sphere gap, differ 10 per cent in kilovolt peak factory calibration.

IODINE

A few years ago in some of our cases we used iodine as an aid to roentgen therapy. The check-over showed 11 iodine cases, out of 25 studied, to have been apparently more stubborn than the expected average. We have discontinued the use of iodine, but feel that a difference of opinion might be tenable by other workers with larger groups. Like many other goiter problems, the iodine question is still open. I suspect we have neglected other drug possibilities in our faith in roentgen therapy.

A vast number of articles (enough to equal these pages in bibliography) has been written on the consideration of thyropathies in the last five years. Of these, 156 have been examined and the titles are alphabetically appended. Clinically, sufficient proof of the value of irradiation would appear to have been established.

Thyroidectomy, as the exclusive best treatment for hyperthyroidism, is being challenged in many quarters to-day. Results claimed for it vary from 18 to 92 per cent of cures. Careful study of later post-operative results, therefore, is needed to clear up (Fig. 6) the question. Almost all of the reports in the surgical and radiologic fields, including this report, have neglected medical and neuropsychiatric consideration.

What treatment to be advised for each patient is a real medical problem—the circumstances of the patient may require a compromise.

The surgeon has a difficult decision to make. He wonders how much thyroid tissue to leave, and what is the physiologic status of this tissue which he has sewed back into place. He does not want to substitute permanent myxedema for a possible temporary hyperthyroidism. He knows that the proper subtotal will give good immediate improvement, but he wants also to know that the patient's health in years to come will be open to no serious doubt. He cannot call cured his post-operative patients with subthyroid illness.

I sympathize with the surgeon when a questionable case insists upon an operation. The surgeon knows, after operation, he has no retreat from a wrong diagnosis. I also sympathize with him when a post-operative

case returns for another radical removal, and there is *nothing*, or only a fraction of a gram, to remove. Exploration for aberrant misplaced thyroid tissue leaves him still in difficulty (Fig. 7).

There are many patients who would be

Fig. 6 *(left)*. A case which exhibited an unusual post-operative scar.
Fig. 7 *(right)*. A patient suffering from post-operative subthyroid illness.

good material in point of courage or patience for either a surgical or roentgen treatment group, who have no positive indications or contra-indications in either direction. If one has confidence in his own method, he has a good brief for helping such a patient to decide. He has, however, neither the sporting nor ethical right to discredit another's method—little known to himself.

The object of this review has been to add, if possible, something to the general appraisal of the value of radiotherapy in the treatment of goiter illness.

Symposia on goiter should foster good understanding among physician, surgeon, and radiologist. We cannot question the conscientiousness and earnestness of one another's work. To learn the best for our patient is our aim, and this will not come through rivalry of different methods of cure, but by the collaboration and co-operation of all.

SUMMARY

We have pointed out the variation of opinion surrounding the field of goiter and its treatment. Based upon the theory of depressing a hyperactive gland function, we have shown our conviction of the value of radiation treatment. After an extended follow-up observation, 200 cases are reported. Classification of group material, treatment technic, progress, and final cure results are discussed. Cases averaged 10 treatments over a period of three and one-half months.

The average drop in pulse was 24.2 beats; average gain in weight, 8 pounds, and lowering in metabolic rate, 23 points.

One hundred and sixty-one cases, or 80.5 per cent, were definitely cured.

Twenty-seven cases, or 13.5 per cent, were improved, making a total of 188, or 94 per cent, either cured or improved (Table III).

Eight, or 4 per cent, recurred after one year, five of which were later re-treated and cured.

Only two cases, or 1 per cent, developed subthyroid symptoms, and only one case, or 0.5 per cent, showed telangiectases.

The importance of unhurried diagnosis and frequent metabolic rate check is emphasized.

CONCLUSION

1. Our own work as here reported has entrenched us in the conviction of the value of irradiation in goiter illness.

2. The bibliography has convinced us that thyroidectomy as the best treatment is open to serious question.

3. We feel certain that the hyperthyroid patient, as a primary problem for the internist, has been underemphasized, and that statistically much is to be desired in diagnosis and follow-up records, so that surgeon, radiologist, and internist may read and speak in the same clinical language, with better understanding, less rivalry, and more collaboration.

BIBLIOGRAPHY

1. Akaiwa, H., and Takeshima, M.: The Reaction of Lymphoid Tissue to Roentgen Radiation. Am. Jour. Roentgenol. and Rad. Ther., July, 1930, XXIV, 42-46.
2. Allison, O. W.: The Radium Treatment of Toxic and Exophthalmic Goiter. Illinois Med. Jour., February, 1929, LV, 133-135.
3. Allison, Robert G.: The X-ray Treatment of Thyrotoxicosis. Radiology, June, 1925, IV, 470-472.
4. Astier, A.: Results and Indications of Radiotherapy in Exophthalmic Goiter. Bull. et mem. Soc. de Radiol. méd. de France, June, 1930, XVIII, 275-278.
5. Ballin, M.: Thyroidism with Unusual Clinical Manifestations. Jour. Michigan St. Med. Soc., February, 1931, XXX, 64-71.
6. Ballin, Max, and Morse, Plinn F.: Parathyroidism and Parathyroidectomy. Ann. Surg., October, 1931, XCIV, 592-609.
7. Barclay, A. E., and Fellows, F. M.: Treated by X-rays: Record of 300 Private Cases. British Jour. Radiol., July, 1927, XXXII, 252-256.
8. Bardachzi, F.: Roentgenotherapy. Strahlentherapie, 1930, XXXV, 173-178.
9. Barker, L. F.: Graves' Disease, Aortic Insufficiency, Vascular Syphilis, Epidemic Encephalitis. Proc. Internat. Assembly Interstate Post-grad. Med. Assn., North America (1928), 1929, pp. 122-127.
10. Bauer, J.: When should Exophthalmic Goiter be Operated on and When Given Ray Treatment? Ars med., Vienna, January, 1931, IX, 3.
11. Bergfeld, W.: The Influence of the Ultraviolet Rays of the Sun and Skyshine on the Thyroid of Rats, with Regard to Basal Metabolism: Studies Proving that Absence of Ultra-violet Rays in Sunlight Is One Cause of Endemic Goiter. Strahlentherapie, 1931, XXXIX, 245-277.
12. Bessesen, Daniel H.: Indications for Surgical Treatment of Diseases of the Thyroid Gland. Med. Jour. and Rec., Oct. 21, 1931, CXXXIV, 389-391.
13. Borak, J.: Ray Therapy in Hyperthyroidism. A Critical Review of the New Literature. Röntgenpraxis, April 15, 1929, I, 145-163.
14. Bram, I.: Goiter: Current Errors in Etiology and Treatment. Endocrinology, March-April, 1926, X, 181-187.
15. Idem: Types of Graves' Disease. Endocrinology, March-April, 1929, XIII, 164-180.
16. Idem: Toxic Adenoma and Graves' Disease; Comments Based upon a Series of 11,000 Goiter Cases. Northwest Med., May, 1929, XXVIII, 210-215.
17. Idem: Goiter, Surgical and Non-surgical. American Med., March, 1931, XXXVII, 146-149.
18. Breitner, B.: Theodor Billroth's Position on the Problem of the Pathologic Physiology of Goiter. Wien. klin. Wchnschr., April 11, 1929, XLII, 475, 476.
19. Idem: On the American Congress. Wien. klin. Wchnschr., June 27, 1929, XLII, 878; also July 4, 1929, 910.
20. Bridenbaugh, J. H.: The X-ray Treatment of Toxic Goiter. Northwest Med., December, 1924, XXIII, 550-552.
21. Büttner, G.: The Significance of the Physiology of the Thyroid in the Pathogenesis and Treatment of Basedow's Disease. Beitr. z. klin. Chir., 1929, CXLVII, 623-638.
22. Chaumet, G.: Radiation in the Therapy of Disturbances of the Sympathetic Nervous System. Médecine, June, 1930, XI, 458-466.
23. Christie, Arthur C.: A Comparison of the Results of Surgical and Roentgen-ray Treatment of Exophthalmic Goiter. Radiology, June, 1925, IV, 464-469.
24. Cignolini, P.: The Effects of Radiotherapy upon Blood Pressure. Radiol. Med., May, 1927, XIV, 381-387.
25. Clarke, B. L. W.: The Radiation Treatment of Hyperthyroidism. Am. Jour. Phys. Ther., March, 1929, V, 564-567.
26. Clarke, N. E., and Black, I.: Post-operative Results in Toxic Goiter. Arch. Int. Med., August, 1930, XLVI, 266-282.
27. Clute, H. M.: The Operative Mortality in

Hyperthyroidism. Jour. Am. Med. Assn., Aug. 9, 1930, XCV, 389-392.
28. CLUTE, H. M., and ADAMS, H. D.: The Diagnosis of Border-line Hyperthyroidism. New England Jour. Med., June 12, 1930, CCII, 1135-1139.
29. COLLER, F. A., and POTTER, EUGENE B.: The End-results of Thyroidectomy. Ann. Surg., October, 1931, XCIV, 568-582.
30. CSEPAI, K., and SUMEGI, S.: Great Improvements after Iodine and Roentgen Treatment. Endokrinologie, March, 1929, III, 192-197.
31. CURTIS, G. M., and DELANEY, P. A.: Cavernous Hemangiectasia Occurring within Nodular Goiter. Trans. Chicago Path. Soc., June 1, 1930, XIII, 300-306.
32. DAVIS, P.: Toxic Goiter. Virginia Med. Monthly, August, 1927, LIV, 310-312.
33. DON, C. S. D.: The Treatment of Exophthalmic Goiter. British Med. Jour., June 22, 1929, I, 1108-1112.
34. DUNHAM, KENNON: X-ray, the Treatment of Choice for Toxic Goiter. RADIOLOGY, May, 1926, VI, 386-399.
35. DUNHILL, T. P.: Toxic Goiter. British Jour. Surg., January, 1930, XVII, 424-450.
36. EDELMAN, L., and ASCHNER, P. W.: The Surgical Pathology of Goiter: a Comparison with Clinical Phenomena in 173 Cases. Am. Jour. Surg., November, 1928, V, 483-490.
37. Editorial. Toxic Goiter. British Med. Jour., Oct. 24, 1931, pp. 760, 761.
38. ELLIOTT, C. A.: The Results of Thyroidectomy for Hyperthyroidism from the Internist's Standpoint. Proc. Internat. Assembly, Inter-state Post-grad. Med. Assn., North America (1930), 1931, VI, 519-524.
39. ENFIELD, C. D.: The Radiation Treatment of Exophthalmic Goiter. Kentucky Med. Jour., March, 1927, XXV, 120-122.
40. ENZER, N.: The Pathology of Nodular Goiter. Ann. Int. Med., June, 1930, III, 1241-1251.
41. FOSS, H. L.: The Pathology of Toxic Goiter. Pennsylvania Med. Jour., March, 1929, XXXII, 413-416.
42. FRASER, F. R.: Toxic Goiter: the Course of the Disease, and its Treatment. British Med. Jour., Oct. 24, 1931, pp. 739-742.
43. FREUND, H. A., and COOKSEY, W. B.: Thyrotoxicosis in Elderly Persons without Signs of Goiter. Jour. Am. Med. Assn., June 14, 1930, XCIV, 1891-1893.
44. GERBER, I.: The Radiation Treatment of Toxic Goiter. New England Jour. Med., Jan. 15, 1931, CCIV, 95-100.
45. GILLETTE, N. W.: A Comparison of Goiters of Continental Europe and the Great Lakes Area of the United States. Ohio St. Med. Jour., August, 1930, XXVI, 685-687.
46. GINSBERG, A. MORRIS: The Historical Development of the Present Conception of Cardiac Conditions in Exophthalmic Goiter. Ann. Int. Med., October, 1931, V, 505-517.
47. GINSBURG, S.: Thyrotoxicosis in Childhood: Early Diagnosis and Radium Therapy. Am. Jour. Dis. Child., May, 1929, XXXVII, 923-943.
48. IDEM: Toxic Adenoma of the Thyroid. Arch. Int. Med., July, 1929, XLIV, 73-117.
49. IDEM: The Value and Place of Radium in the Treatment of Diseases of the Thyroid Gland. Am. Jour. Roentgenol. and Rad. Ther., September, 1930, XXIV, 283-297.
50. GOETTE, K.: Injuries from Roentgen Treatment (Adhesions, Myxedema, Hyperthyroidism). Fortschr. a. d. Geb. d. Röntgenstr., January, 1929, XXXIX, 111-113.
51. GOODWIN, G. M., and LONG, W. B.: Roentgen-ray Therapy in the Treatment of Exophthalmic Goiter. Am. Jour. Med. Sci., January, 1924, CLXVII, 38-54.
52. GRAHAM, A.: Exophthalmic Goiter and Toxic Adenoma, Clinical Variations of a Single Disease. Jour. Am. Med. Assn., Aug. 28, 1926, LXXXVII, 628-631.
53. GRAY, J. W.: The Pathology of the Thyroid Gland. Jour. Lab. and Clin. Med., June, 1929, XIV, 829-834.
54. GRIER, G. W.: Is Irradiation a Satisfactory Treatment for Substernal Thyroid? Am. Jour. Roentgenol. and Rad. Ther., April, 1925, XIII, 327-330.
55. IDEM: X-ray Treatment. Ann. Int. Med., October, 1927, I, 241-246.
56. GROOVER, T. A., CHRISTIE, A. C., MERRITT, E. A., COE, F. O., and MCPEAK, E. M.: Roentgen Irradiation in the Treatment of Hyperthyroidism: Statistical Evaluation Based on 305 Cases. Jour. Am. Med. Assn., May 25, 1929, XCII, 1730-1734.
57. GUDZENT, F.: The Radiotherapy of Toxic Goiter. Klin. Wchnschr., Dec. 16, 1924, III, 2329-2331. Abstracted in Jour. Am. Med. Assn., Feb. 7, 1925, LXXXIV, 477.
58. IDEM: The Radium Therapy of Basedow's Disease. Strahlentherapie, 1928, XXX, 634-643.
59. GUDZENT, F., and KUSSAT, E.: Radium Treatment. Deutsche med. Wchnschr., May 13, 1927, LIII, 823-825.
60. HAMBURGER, W. W., and LEV, M. W.: Masked Hyperthyroidism. Jour. Am. Med. Assn., June 28, 1930, XCIV, 2050-2056.
61. HARSHA, W. T.: The Structure of the Thyroid Gland in Toxic Goiter. Med. Clin. North America, September, 1929, XIII, 501-513.
62. HAYER, E., and HUFSCHMID, W.: The Technic and Results of Roentgen Irradiation in Thyrotoxicosis. Strahlentherapie, 1930, XXXVI, 477-490.
63. HAYES, M. R. J.: X-ray Treatment of 100 Cases of Graves' Disease. Irish Jour. Med. Sci., May, 1926, pp. 204-215.
64. IDEM: A Study of the X-ray Treatment of 100 Cases of Graves' Disease. British Jour. Radiol., February, 1927, XXXII, 64-69.
65. HELLWIG, C. A.: Graves' Constitution (Warthin). Surg., Gynec. and Obst., January, 1931, LII, 43-51.
66. HERTZLER, A. E.: The Development and Nature of So-called Toxic Adenoma. November-December, 1927.
67. HERZFELD, E., and FRIEDER: Blum's Diet, a Hormonal Substitution Therapy in Basedow's Disease. München. med. Wchnschr., Feb. 6, 1931, LXXVIII, 226-228.
68. HESS, P., and SCHLECHT, H.: Radiotherapy: Reasons for Successes and Failures in Basedow's Disease. München med. Wchnschr., Jan. 9, 1931, LXXVIII, 55-57.
69. HILL, H. GARDINER: Varieties of Simple and Thyrotoxic Goiter and Their Differentiation. Post-grad. Med. Jour., March, 1930, V, 99-103.
70. HOAGLAND, ARTHUR W.: Clinical Study of 500 Consecutive Thyroidectomies. Med. Jour. and Rec., Oct. 21, 1931, CXXXIV, 383-386.

71. Högler, F., and Herz, B.: Erythropoiesis in Patients with Exophthalmic Goiter before and after Radium Treatment and in Artificially Produced Hyperthyroidism. Wien. klin. Wchnschr., May 1, 1930, XLIII, 553-555.
72. Holzknecht, G.: The Roentgen Therapy of Basedow's Disease. Strahlentherapie, 1928, XXX, 605-612.
73. Idem: The Roentgen Treatment of Morbus Basedowii. Radiology, February, 1930, XIV, 139-144.
74. Jackson, A. S.: Common Mistakes in the Diagnosis and Treatment of Goiter. Illinois Med. Jour., February, 1931, LIX, 103-108.
75. Jaguttis, P.: Results in the Roentgen Treatment of Thyrotoxicosis. Strahlentherapie, 1930, XXXVIII, 557-574.
76. Jenkinson, E. L.: Exophthalmic Goiter, Roentgenotherapy. Illinois Med. Jour., January, 1927, LI, 56-62.
77. Idem: Thyroid Disease. Radiology, June, 1925, IV, 453-457.
78. Idem: The Roentgen Therapy of Exophthalmic Goiter. Radiology, May, 1926, VI, 380-385.
79. Joyce, Thomas N.: Thyroid Surgery at the Portland Clinic. Ann. Surg., October, 1931, XCIV, 563-568.
80. Jugenburg, A.: Roentgenotherapy in Middle-aged Women. Strahlentherapie, 1930, XXXV, 491-502.
81. Keilty, R. A.: Pathology: the Inflammatory Nature of Nodular Goiter as Chronic Thyroiditis. Am. Jour. Clin. Path., January, 1931, I, 57-68.
82. Kendall, Edward C.: The Consideration of Some of the Glands of Internal Secretion from a Chemical Viewpoint. Endocrinology, September-October, 1931, XV, 357-365.
83. Kepler, Ediom, and Boothby, Walter M.: Creatinuria in Hyperthyroidism. Am. Jour. Med. Sci., October, 1931, CLXXXII, 476-484.
84. Kilduffe, R. A.: Laryngeal Necrosis as a Possible Complication of the Treatment of Goiter by Irradiation. Arch. Otol., August, 1928, VIII, 185-187.
85. King, B. T.: Toxic Goiter, its Clinical History, with a Review of 500 Cases. Northwest Med., February, 1927, XXVI, 101-106.
86. Kunde, M. M.: Differential Improvements in the Symptoms of Toxic Goiter during Roentgen-ray Treatment and Rest. Arch. Int. Med., June, 1924, XXXIII, 758-762.
87. Labbé, M.: Indications and Methods for the Treatment of Toxic Goiter. Vie méd., March 25, 1929, X, 311-313.
88. Larkin, A. J.: Radium in 20 Cases of Hyperthyroidism. Illinois Med. Jour., June, 1926, XLIX, 468, 469.
89. Levine, S. A., and Walker, George L.: Further Observations on Latent Hyperthyroidism Masked as Heart Disease: Angina Pectoris. New England Jour. Med., Nov. 21, 1929, CCI, 1021-1030.
90. Lorey, A.: Roentgenotherapy. Deutsche med. Wchnschr., Feb. 14, 1930, LVI, 259-261.
91. Loucks, R. E.: The Radium Treatment of Thyrotoxicosis. Radiology, June, 1925, IV, 473-479.
92. Idem: Clinical Evidence of Thyrotoxic Control after Radium Therapy. Am. Jour. Roentgenol. and Rad. Ther., December, 1927, XVIII, 509-514.
93. Idem: Ten Years' Results with Radium in the Treatment of Toxic Goiter. Am. Jour. Roentgenol. and Rad. Ther., September, 1930, XXIV, 280-282.
94. Luginbuhl, C. B.: Clinical Aspects of Toxic Goiter. Jour. Iowa Med. Soc., May, 1927, XVII, 154-159.
95. Idem: Neglected Toxic Goiter. Jour. Iowa Med. Soc., December, 1928, XVIII, 453-458.
96. Marine, D.: Studies on the Etiology of Goiter, Including Graves' Disease (McBride Lecture). Ann. Int. Med., November, 1930, IV, 423-432.
97. Idem: Remarks on the Pathogenesis of Graves' Disease. Am. Jour. Med. Sci., December, 1930, CLXXX, 767-772.
98. Marine, D., Baumann, E. J., and Webster, B.: The Value of Hexuronic Acid in the Treatment of Graves' Disease with Suprarenal Cortex. Proc. Soc. Exper. Biol. and Med., December, 1930, XXVIII, 327-329.
99. Martin, J. M.: The X-ray Treatment of Toxic Goiter. Texas St. Jour. Med., April, 1927, XXII, 751-755.
100. McCallum, G.: Changes in the Thyroid Gland Following the Administration of Iodine in Cases of Exophthalmic Goiter. Trans. Royal Med.-chir. Soc. Glasgow, 1930, XXIV, 42-53.
101. McEwan, P.: Toxic Goiter. British Med. Jour., Dec. 28, 1929, II, 1191-1193.
102. McGuffin, W. H.: Goiter from the Radiologist's Viewpoint. Canadian Med. Assn. Jour., October, 1930, XVI, 1182-1187.
103. Mellanby, E., and others: The Treatment of Exophthalmic Goiter. (Iodine, Surgery, Radiation.) Proc. Royal Soc. Med. (sections on Surgery, Medicine, Electrotherapy, and Therapy), June, 1926, XIX, 101-132.
104. Menne, F. R.: The Thyroid Gland in Hyperthyroidism. Arch. Path., December, 1929, VIII, 954-975.
105. Meyer, W. H.: Roentgen Therapy in Hyperthyroidism; Report of 328 Cases of Thyrotoxicosis Subjected to X-ray Treatment. Med. Jour. and Rec., Feb. 1, 1928, CXXVII, 137-141.
106. Moschcowitz, E.: The Nature of Graves' Disease. Arch. Int. Med., October, 1930, XLVI, 610-629.
107. Muir, Joseph: Radio-active Substances: Their Therapeutic Uses and Application. The Radium Treatment of Hyperthyroidism. Radiology, March, 1927, VIII, 223-229.
108. Naffziger, Howard C.: Progressive Exophthalmos Following Thyroidectomy: Its Pathology and Treatment. Ann. Surg., October, 1931, XCIV, 582-587.
109. Petersen, W. F., and Levinson, S. A.: Skin Reactions, Blood Chemistry, and Physical Status of the Patient with Exophthalmos and the Nervous Patient. Arch. Path., January (Part 2), 1930, IX, 267-281.
110. Pfahler, G. E., and Vastine, J. H.: Results of Roentgen Therapy in Goiter, Based upon Observations in 400 Cases. Am. Jour. Roentgenol. and Rad. Ther., October, 1930, XXIV, 395-411.
111. Pordes, F.: Indications for and Technic of Roentgen Irradiation in Various Disturbances. Strahlentherapie, 1929, XXXIII, 652-666.
112. Powell, E. V.: Irradiation Therapy in Thyro-

toxicosis. Texas St. Jour. Med., November, 1929, XXV, 457-462.
113. Rahm, H.: The Problem of Basedow's Disease. Beitr. z. klin. Chir., 1929, CXLVIII, 189-213.
114. Remer, John, and Belden, W. W.: X-ray Diagnosis and Treatment of Thyroid Disease. Radiology, February, 1930, XIV, 145-151.
115. Reveno, W. S.: The Cause of Exophthalmic Goiter, a Biochemical Hypothesis. Arch. Int. Med., October, 1931, XLVIII, 592-598.
116. Richter, H. M.: The Place of Radiotherapy in the Treatment of Thyrotoxicosis. Am. Jour. Surg., July, 1930, IX, 115-117.
117. Rieder, W.: The Limitations of Roentgen Treatment. Strahlentherapie, 1930, XXXVI, 64-87.
118. Rienhoff, W. Francis: The Lymphatic Vessels of the Thyroid Gland in the Dog and in Man. Arch. Surg., November, 1931, XXIII, 783-805.
119. Rowe, E. W.: The Roentgen Treatment of Toxic Goiter. Endocrinology, May, 1924, VIII, 389-403.
120. Sanger, B. J.: Exophthalmic Goiter, a Follow-up Study of Cases Treated with the Roentgen Ray. Arch. Int. Med., May, 1926, XXXVII, 627-640.
121. Scal, J. C.: Hypertrophied Thyroids Treated with Radium. Med. Jour. and Rec. (Supp.), Dec. 16, 1925, CXXII, 745-747.
122. Shouse, S. S.: Exophthalmic Goiter in a Child, Aged 5 Years. Am. Jour. Surg., January, 1931, XI, 124-127.
123. Simons, B.: Additional Report on Basedow's Disease. Beitr. z. klin. Chir., 1929, CXLVIII, 67-83.
124. Simpson, C. Augustus: The X-ray Treatment of Hyperthyroidism and Toxic Goiter. Radiology, November, 1924, III, 427-431.
125. Skinner, E. H., and Lockwood, I. H.: The Radiotherapy of Goiter. Jour. Missouri Med. Assn., January, 1926, XXVIII, 11-13.
126. Slesinger, E. G.: The Treatment of Toxic Goiter. Post-grad. Med. Jour., January, 1931, VI, 51-57; also Med. Press, Feb. 11, 1931, CXXXI, 121, and Feb. 18, 1931, 137.
127. Sloan, E. P.: Medical, X-ray, and Surgical Treatment of Goiter. Jour. Kansas Med. Soc., August, 1925, XXV, 245-249.
128. Idem: Medical, X-ray, and Surgical Treatment of Goiter. West Virginia Med. Jour., January, 1927, XXIII, 32-35.
129. Idem: Two Types of Toxemia in Toxic Adenoma. Jour. Michigan Med. Soc., July, 1928, XXVII, 440-443.
130. Sluys, F.: Concerning Post-radiotherapeutic Accidents and Incidents in the Treatment of Hyperthyroidism. Jour. de Radiol. et d'Electrol., April, 1931, XV, 190-193.
131. Soiland, A., Costolow, W. E., and Meland, O. N.: The Results of the Radiotherapy of Basedow's Disease and Toxic Goiter. Strahlentherapie, 1929, XXXII, 131-142.
132. Idem: Radiotherapy, Its Place in the Treatment of Toxic Thyroid Disease. Am. Jour. Surg., July, 1930, IX, 123-125.
133. Stevens, J. Thompson: Toxic Goiter: Its Treatment by Means of Radium and the Roentgen Rays: Results Controlled with Basal Metabolism Tests. Radiology, January, 1926, VI, 7-13.
134. Idem: Roentgen and Radium Treatment of Toxic Goiter and Hyperthyroidism. Phys. Therap., July, 1930, XLVIII, 343-351.
135. Sutton, D. C.: The Non-surgical Treatment of Hyperthyroidism. Am. Jour. Surg., July, 1930, IX, 118-122.
136. Thiemann, H.: The Results of the Roentgenologic Treatment of Simple Goiter and Exophthalmic Goiter. Strahlentherapie, 1928, XXX, 759-807.
137. Thomas, H. M., Jr.: The Modern Treatment of Goiter, Toxic and Non-toxic. Illinois Med. Jour., November, 1926, L, 385-388.
138. Thompson, W. O., Morris, A. E., and Thompson, P. K.: Thyrotoxicosis Following Subtotal Thyroidectomy for Exophthalmic Goiter. Arch. Int. Med., December, 1930, XLVI, 946-978.
139. Tinker, Martin B.: Electrosurgery with Special Reference to Goiter and Malignancy. Ann. Surg., October, 1931, XCIV, 587-592.
140. Topper, A., and Mulier, H.: Enlargement of the Thyroid Gland in Children; a Study of 100 Cases of So-called Simple Goiter. Am. Jour. Dis. Child., November, 1930, XL, 974-984.
141. Wahle, G. H.: Surgical *versus* X-ray Treatment of Hyperthyroidism. Northwest Med., April, 1927, XXVI, 202, 203.
142. Walter, O. M., Anson, B. J., and Ivy, A. C.: The Effect of X-rays on the Thyroid and Parathyroid Glands. Radiology, January, 1931, XVI, 52-58.
143. Warthin, A. S.: The Constitutional Entity of Exophthalmic Goiter and So-called Toxic Adenoma. Ann. Int. Med., December, 1928, II, 553-570.
144. Idem: The Significance of the Lymphoid Tissue in Exophthalmic Goiters and So-called Toxic Adenomas. Read before the annual meeting of the American Association of Pathologists and Bacteriologists, New York, April 17, 18, 1930. Abstracted in Arch. Path., 1930, X, 163, 164.
145. Idem: Goiter. Pathology. Proc. Internat. Assembly Inter-state Post-grad. Med. Assn., North America (1929), 1930, V, 383-385.
146. Warthin, A. S., and Simpson, W. M.: Graves' Constitution. Am. Jour. Surg., July, 1929, VII, 22-26.
147. Warwick, M.: The Pathology of Toxic Goiter. Minnesota Med., July, 1927, X, 411, 412.
148. Webster, B., and Chesney, A. M.: The Etiology of Simple Goiter. Am. Jour. Path., May, 1930, VI, 275-284.
149. Webster, J. H.: The Radiation Treatment of Exophthalmic Goiter. British Med. Jour., June 12, 1926, I, 985, 986.
150. Wechsler, I. S., and Savitsky, Nathan: Hyperthyroidism Associated with the Parkinsonian Syndrome. Jour. Am. Med. Assn., Oct. 31, 1931, XCVII, 1238-1286.
151. Wegelin, C.: The Pathologic Anatomy of Endemic Goiter and the Control of Goiter in Switzerland. Internat. Clin., December, 1926, IV, 38-46.
152. Weil, M. P., and Iselin, M.: Recent Conception of Toxic Adenomas of the Thyroid and Their Relations to Exophthalmic Goiter. Presse méd., Feb. 5, 1930, XXXVIII, 173-177.
153. Williamson, G. S., and Pearse, I. H.: The Pathologic Classification of Goiter. Jour.

Path. and Bacteriol., April, 1925, XXVIII, 361-387.
154. Idem: Evidence Drawn from a Study of the Therapeutics of Graves' Disease, of Two Functions in Thyroid Physiology. Quart. Jour. Med., October, 1928, XXII, 21-31.
155. Wyatt, O. W.: The Treatment of Thyrotoxicosis by Ultra-violet and X-ray. Jour. Radiol., June, 1924, V, 197-200.
156. Zwefil, E. H.: The X-ray Treatment of Goiter. Nebraska Med. Jour., November, 1926, XI, 419-422.

Invents Tiny Apparatus to Regulate Radium Treatment.—A tiny apparatus hardly larger than a pea, so small that it can be introduced into most cavities of the human body, has been devised by Dr. Louis Mallet, head of the laboratory of the anti-cancer center of Tenon Hospital, Paris, to help physicians measure the amount of radiation that reaches various organs and parts of the body during radium treatment. The apparatus has been described in a report made to the French Academy of Sciences. It consists of a small metal knob, the size of a pinhead, within a slightly larger metal enclosure. The air between the two does not conduct electricity under ordinary conditions, but becomes conducting under the influence of radium. Such a tiny chamber is first screwed onto an apparatus which charges it to about 160 volts. Then it is introduced into any part of the body, such as the throat, which is being exposed to radium. After a given time the ionizing chamber is taken out and its loss of voltage measured. This gives a measure of the intensity of radiation to which the chamber has been exposed in the body, and consequently, of the amount of radiation to which that part of the body has been exposed in the given time.

Dr. Mallet is already known for his invention of a similar device which is used in many hospitals for measuring indirectly the strength of radiation employed in cancer treatment. The advantage of the new method is that one or more of the ionizing chambers can be introduced directly into the body, and that they can be sent out to be used by physicians and afterwards returned to a central laboratory for measurement.—*Science Service.*

THE RADIOLOGIC ASPECT OF THYROTOXICOSIS[1]

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IN the surgical fraternity it is common to hear depreciation of the treatment of thyrotoxicosis by radiation therapy. It is said by some that, because surgery has been shown to offer a large percentage of cures with a low mortality rate, there is no need for any other method of treatment. In a few large surgical clinics of this country, excellent results have been obtained in the treatment of toxic goiter by operation, with a low mortality rate. Unfortunately, such brilliant results are not representative of those obtained by the general surgeons, who are, perhaps, competent in other fields of surgery, but lack the skill and experience so necessary in goiter surgery. Perhaps their attitude of opposition to radiation therapy would be altered if reliable statistics could be obtained on the number of cures, improvements, failures, and deaths following operation for toxic goiter by the general surgeon. If it were possible to procure such statistics, no doubt a certain number of cures and a surprisingly large number of failures and deaths would be revealed.

In one of the largest surgical clinics in America, 10,781 cases of simple toxic and exophthalmic goiter were operated on during the period from 1924 to 1930, inclusive, with a mortality rate of 1.17 per cent. This small percentage of deaths is truly remarkable and speaks well for the great skill of certain American surgeons, who, on account of their wide experience in goiter operation, have become experts. If such a low mortality rate represented the results obtained by general surgeons throughout this country, there could be but a slight argument for any other form of treatment. Unfortunately, this mortality rate does not prevail.

[1]Read before the Radiological Society of North America at the Seventeenth Annual Meeting, at St. Louis, Nov. 30–Dec. 4, 1931.

MacLean (1), in 1921, made a survey to ascertain the surgical mortality in exophthalmic goiter, sending questionnaires to 100 American and Canadian hospitals. The replies indicated that a mortality rate of 8 per cent existed at that time. Some time later, he sent questionnaires to 200 additional hospitals, and obtained about the same percentage, the mortality rate being then 7 per cent. In 1929, Cooke (2) stated that there was a general increase in surgical mortality rates during recent years, and that thyroid surgery headed the list, with a mortality rate which had increased 250 per cent in the preceding two decades. He believed the reason for this increase to be that every local surgeon to-day operates on goiter cases, while several years ago operation was done by only a few experts.

There are many causes which produce deaths during and following surgical operation for toxic goiter, which have been divided into immediate and post-operative causes.

The causes for immediate deaths, according to C. Mayo (3) are:

1. Hemorrhage
2. Air embolism
3. Myocarditis
4. Suffocation or the anesthetic.

The causes of post-operative deaths are:

1. Pneumonia
2. Sepsis
3. Tetany, or myxedema.

Recent animal experimental work by Nordland, Hall, and St. Cyr (4) has shown that air embolism is a possible cause of sudden death during thyroidectomy. They state that "a patient with toxic goiter is much more susceptible to fatal air embolism than a patient with non-toxic goiter."

In reviewing the causes of death during and following operation, we find that myxedema is the only one which could be produced by radiation therapy, and it is only on the rarest occasions that this occurs. No stronger argument could be advanced in favor of radiation therapy in the treatment of toxic goiter than the dangers encountered in the surgical treatment of this disease.

There was a time when gastric and duodenal ulcers were regarded as purely surgical conditions. At the present time, however, many of these ulcers are being cured by non-surgical methods. So it is with toxic goiter. For a long time the treatment was medical, then surgical. At the present time, both methods are used, and, since the addition of radiation therapy, the need for surgical operation and the mortality rate have been markedly lessened.

Radiation therapy is now considered by the better informed members of the medical profession as indispensable in the treatment of certain kinds of goiter, as is surgery in other types. Bardachzi (5) says: "Roentgen therapy has become as indispensable a part of the treatment as surgery. Irradiation with a correct technic is free of danger and the mortality after operation is from 3 to 4 per cent. There is about 20 to 30 per cent recurrence after surgery and only 10 to 20 after irradiation."

The excellent results obtained in the treatment of toxic goiter by irradiation are not alone due to the changes produced in the gland when it is in a state of hyperfunction, but they are also thought to be due in a measure to the irradiation of the thymus gland. It is presently believed that the thymus gland undergoes certain changes in cases of thyrotoxicosis, and also that the benefit received in post-operative hyperthyroidism by radiation therapy is probably due, to a certain extent, to the irradiation which the thymus gland receives. Schwarz (6) recommends that the thymic region should be included in the field of treatment while irradiating the thyroid gland, and that the larynx and trachea should be protected.

The normal thyroid gland is not considered radiosensitive by some authorities, and the effect of irradiation is manifested only when the gland is in a state of hyperfunction.

Meyer (7) concludes from animal and clinical observations: "The thyroid gland belongs rather with the group of radioresistant than with the radiosensitive organs." He also states: "From the viewpoint of pathology as well as from the clinical observation, an adenoma, or newgrowth of the thyroid, in which the cellular elements are increased, is more sensitive to radiation than a cystic or colloidal tumefaction." This may account for reported failures of radiation therapy in certain types of goiters. However, Holzknecht (8) states that the action of the X-rays results in inhibition or depression of the growth and function of the cells. X-radiation cures in hyperfunction and secretory hyperplasia in the same way as does surgical reduction.

Very often the statement is made that an irradiated thyroid gland becomes difficult to remove by operation because of adhesions, believed to be due to radiation therapy. Because of the lack of experimental evidence substantiating this belief, we are sometimes inclined to think this is, in many instances, simply propaganda against the use of radiation therapy in the treatment of toxic goiters. Soiland, Costolow, and Meland (9) say that reports from prominent surgeons and pathologists have discredited the belief that irradiated thyroids are more difficult to operate. They say:

> The general agreement is that it is impossible for the surgeon and pathologist to pick out cases which have had previous irradiation. Difficult operation is often met with in cases in which there has been previous thyroiditis

with fibrosis, so some of the operative difficulties ascribed to radiation probably have no relation to previous irradiation. However, if the cases are properly selected for irradiation, it is very seldom that surgery will ever be needed.

In this regard, we find that Holzknecht (10) says: "Only those patients suffering with Basedow's disease should be operated on who do not respond to roentgen rays, cases with large struma, compression of the trachea, or very acute cases of Basedow's disease which do not respond favorably to radiation. Following moderate doses, there are no adhesions formed to render a future operation difficult." This factor has been ruled out by statistics which prove that the adhesions, if found, were already there before the treatment and that they occurred in untreated as well as in treated cases.

We radiologists have known for many years that we have in radiation therapy a valuable agent with which to treat toxic goiters. We also recognize that the percentage of cures has been, in fact, high when compared with that of surgery, and with practically no mortality. We know that, in thyrotoxicosis, the results from radiation therapy would be greatly improved if the medical profession could be made to appreciate that the radiologist should be given the same latitude as the surgeon in treating these cases. Many radiologists have experienced the unpleasant situation of having a case of goiter referred for radiation therapy, the referring physician, at the same time, treating the patient medically, often being the one to instruct the patient when, and when not, to take radiation treatment. It would seem that the physician simply lends his patient to the radiologist. This lack of co-operation not only confuses the radiologist, who is often uninformed of the nature of this outside treatment, but offsets the good he could accomplish if the patient were kept under his constant personal supervision. It is high time for the radiologic profession to assert itself in this regard. This can best be accomplished by educating the medical profession through presenting to it irrefutable statistics showing the high percentage of cures and improvements, with practically no mortality, when cases of thyrotoxicosis are treated by radiation therapy, and also the large number of cases treated by the radiologist which had previously been operated on. Perhaps in this manner they will be made to appreciate the great value of radiation therapy and will realize the need for closer co-operation with the radiologist.

In order to obtain such statistics, questionnaires were sent to 200 radiologists, some of whom were practising in large cities, some in small cities, and others in towns and rural districts. In this manner, we hoped to receive replies which would be representative of the results obtained by radiologists of varied experience with radiation therapy in goiter. Such statistics would be different from the usual surgical statistics which often represent the results of some skilled surgeons at a large surgical center and do not always represent the experience of the general surgeon.

At this time, 75 replies, representing 38 states, have been received. The smallest number of cases treated was 3 and the largest number was 1,500. Out of the 75 replies, 27 stated that they had either lost their records, or did not use radiation therapy in the treatment of goiter. The replies indicated that the method of distribution was very fair and should make this report an interesting one for statistical study.

In order to facilitate the study of the replies received, we have grouped them in eight classes, including one table. A study of the various divisions discloses some interesting data. Groups 1 and 3, with the smallest number of cases (63 and 328 respectively), show the lowest percentage

UNITED STATES	1 Percentage of cures	2 Percentage showing marked improvement	3 Percentage of recurrences	4 Percentage of failures	5 Percentage treated after operation	6 No. of cases in which surgery failed	7 Total number of cases
Arkansas	60.0	20.0	0	20.0	0	0	20
Arkansas	54.0	24.0	0	12.0	18.0	2.8	16
California	No records but all patients treated were benefited.						
California	50.0	43.0	5.0	7.0	10.0	36.0	360
California	73.0	16.0	....	11.0	3.0	22.5	750
California	Do not treat.						
California	70.0	0	0	30.0	10.0	15.0	150
Colorado	64.7	35.3	26.4	0	17.6	22.8	130
Colorado	50.0	50.0	0	0	....	....	6
Colorado	65.0	20.0	26.0	15.0	17.0	6.0	34
Connecticut	21.8	69.9	7.1	8.3	1.0	0.6	60
Delaware	Do only diagnostic work.						
D. C. (Wash.)	85.0	0	10.0	15.0	20.0	60.0	300
D. C. (Wash.)	88.85	8.52	1.31	2.63	8.5	25.92	305
Florida	90.0	5.0	0	5.0	0	0	50
Florida	Do not treat.						
Georgia	....	....	10.0	....	3.0	0.96	32
Georgia	94.0	6.0	0	0	12.0	4.2	35
Illinois	70.32	23.0	3.0	7.0	2.0	3.34	167
Illinois	70.0	25.49	4.5	4.29	7.0	40.8	583
Illinois	60.0	40.0	....	0	....	....	50
Illinois	Not treating.						
Illinois	30.0	20.0	10.0	50.0	5.0	5.5	110
Illinois	80.0	15.0	10.0	5.0	9.8	100.0	1,020
Illinois	67.0	17.0	5.0	16.0	20.0	100.0	500
Illinois	80.0	4.0	12.0	16.0	10.0	38.5	385
Indiana	No records.						
Iowa	80.0	15.0	10.0	5.0	50.0	35.0	70
Iowa	25.0	50.0	....	25.0	....	....	....
Iowa	Do not treat.						
Kansas	60.0	25.0	15.0	15.0	25.0	9.25	37
Kansas	85.0	5.0	15.0	10.0	20.0	40.0	200
Kentucky	85.0	15.0	....	0	2.0	4.0	200
Louisiana	72.0	22.0	2.0	6.0	2.0	2.0	103
Louisiana	70.0	28.5	....	1.5	2.0	5.5	275
Maine	Do not treat.						
Maryland	Do not treat.						
Maryland	No record.						
Massachusetts	72.0	0	27.0	27.0	0	0	18
Michigan	Do not treat.						
Michigan	Do not treat.						
Minnesota	95.0	0	0	5.0	10.0	40.0	400
Minnesota	....	....	....	....	14.0	6.16	44
Minnesota	Do not treat.						
Minnesota	Do not treat.						
Mississippi	No records.						
Missouri	No records.						
Nebraska	70.0	10.0	7.0	20.0	10.0	14.0	140
Nebraska	75.0	20.0	33.33	5.0	18.0	54.0	300
New Jersey	90.0	4.44	....	5.56	....	....	270
New Jersey	73.0	21.0	5.0	6.0	0	0	44
New York	66.0	16.0	0	18.0	....	....	328
New York	Do not treat.						
New York	Do not treat.						
New York	33.3	33.3	....	33.3	0	0	100
New York	19.44	47.23	4.17	33.33	30.55	11.0	36
North Dakota	32.0	45.0	....	23.0	16.0	4.8	30
North Dakota	Do not treat.						
Ohio	Do not treat.						
Oregon	Do not treat.						
Pennsylvania	86.0	14.0	2.6	0	12.0	63.8	532
Pennsylvania	87.5	8.0	....	4.5	8.0	32.0	400
Pennsylvania	40.0	15.0	25.0	45.0	5.0	7.6	153
Rhode Island	Do not treat.						
South Dakota	24.0	60.0	4.0	16.0	8.0	2.0	25
Texas	95.0	0	10.0	5.0	1.0	0.2	21

(Continued on next page)

UNITED STATES	1 Percentage of cures	2 Percentage showing marked improvement	3 Percentage of recurrences	4 Percentage of failures	5 Percentage treated after operation	6 No. of cases in which surgery failed	7 Total number of cases
Utah	50.0	40.0	....	10.0	7.5	10.5	141
Vermont	Do not treat.						
Virginia	No record.						
Washington	Do not treat.						
Washington	Do not treat.						
Wisconsin	100.0	0	0	0	0	0	3
Wisconsin	Do not treat.						
CANADA							
Alberta	60.0	20.0	15.0	20.0	3.0	3.2	108
Ontario	77.5	12.5	7.5	10.0	10.0	150.0	1,500
Totals	3,046.41	969.18	312.91	573.41	427.95	979.93	10,541
	(46)	(46)	(37)	(46)	(43)	(43)	(47)
Averages	66.22	21.07	8.45	12.4	9.95	22.78	224.27

SUMMARY OF GENERAL AVERAGES

75 replies
(35, United States; 1, Washington, D. C.; 2, Canada)

1 Percentage of cures	2 Percentage showing marked improvement	3 Percentage of recurrences	4 Percentage of failures	5 Percentage treated after operation	6 Number of cases in which surgery failed	7 Total number of cases	8 Do not treat	9 No records
66.22	21.07	8.45	12.4	9.95	979.93	10,541	21 28%	6 8%

of cures, whereas Group 8, with the largest number of cases (3,270), shows the highest percentage of cures. However, the average of all the groups is high.

Out of a total of 10,541 cases treated by radiation therapy, 980 had previously been operated on. The percentage of recurrences is low and should compare favorably with that of surgery. In fact, a superficial search of the medical literature indicates that recurrences after surgery are placed by some at from 20 to 30 per cent; however, in this series of 10,541 irradiated cases, it was only 8.45 per cent.

It must be concluded from this statistical study that radiation therapy is a safe form of treatment in thyrotoxicosis and the percentage of cases is comparable with that of surgery, the recurrences being perhaps less. This survey clearly shows that radiologists are capable of satisfactorily treating cases of thyrotoxicosis, and that the splendid results obtained with radiation therapy are not restricted to a few radiologists of great experience but are general among the radiologists of this country.

It should, therefore, be appreciated that radiation therapy at the present time offers more to certain goiter patients than any other form or forms of treatment. Myxedema is the only one of the many immediate and post-operative causes of death to such patients when operated on which can be produced by excessive radiation therapy, and this happens only occasionally. For this reason, radiation therapy is the safest of any single method of treatment. It offers as high a percentage of cures, with less percentage of recurrence, and its economic consideration is of importance. Patients are

SUMMARY BY GROUPS

GROUP I
(5–20 Cases)

1	2	3	4	5	6	7	
Percentage of cures	Percentage showing marked improvement	Percentage of recurrences	Percentage of failures	Percentage treated after operation	Number of cases in which surgery failed	Total number of cases	
25	50	....	25	....	....	....	
50	50	0	0	0	0	6	
60	20	0	20	0	0	20	
100	0	0	0	0	0	3	
54	24	0	12	18	2.8	16	
72	0	27	27	0	0	18	
361	144	27	84	18	2.8	63	(Totals)
60.1	24	5.4	14	3.6	.56	12.6	(Averages)

GROUP II
(20–50 Cases)

90	5	0	5	0	0	50	
....	....	10	....	3	0.96	32	
94	6	0	0	12	4.2	35	
60	40	....	0	0	0	50	
60	25	15	15	25	9.25	37	
....	....	....	....	14	6.16	44	
32	45	....	23	16	4.8	30	
73	21	5	6	0	0	44	
95	0	10	5	1	0.2	21	
65	20	26	15	17	6.0	34	
19.44	47.23	4.17	33.33	30.55	11.0	36	
24	60	4.0	16.0	8	2.0	25	
612.44	269.23	74.17	118.33	126.55	44.57	438	(Totals)
61.24	26.92	8.24	11.83	10.54	3.71	36.5	(Averages)

GROUP III
(50–100 Cases)

55.0	43.0	2.0	2.0	10	9.8	98	
33.3	33.3	....	33.3	0	0	100	
80.0	15.0	10.0	5.0	50	35.0	70	
21.8	69.9	7.1	8.3	10	0.6	60	
190.1	161.2	19.1	48.6	70	45.4	328	(Totals)
47.5	40.3	6.3	12.15	17.5	11.3	82	(Averages)

GROUP IV
(100–200 Cases)

64.7	35.3	26.4	0	17.6	22.8	130	
70.0	0	0	30.0	10.0	15.0	150	
70.0	23.0	3.0	7.0	2.0	3.54	167	
30.0	20.0	10.0	50.0	5.0	5.5	110	
85.0	15.0	....	0	2.0	4.0	200	
70.0	10.0	7.0	20.0	10.0	14.0	140	
85.0	5.0	15.0	10.0	20.0	40.0	200	
72.0	22.0	2.0	6.0	2.0	2.0	103	
40.0	15.0	25.0	45.0	5.0	7.6	153	
50.0	40.0	....	10.0	7.5	10.5	141	
60.0	20.0	15.0	20.0	3.0	3.2	108	
696.7	205.3	103.4	198.0	84.1	128.14	1,602	(Totals)
63.3	18.6	11.4	18.0	7.6	11.63	145.6	(Averages)

(Continued on next page)

GROUP V
(200–300 Cases)

1	2	3	4	5	6	7	
Percentage of cures	Percentage showing marked improvement	Percentage of recurrences	Percentage of failures	Percentage treated after operation	Number of cases in which surgery failed	Total number of cases	
85	0	10	15	20	60	300	
75	20	33.3	5	18	54	300	
90	4.44	....	5.56	....	....	270	
70	28.5	....	1.5	2	5.5	275	
320	52.94	43.3	27.06	40	119.5	1,145	(Totals)
80	13.23	21.6	6.74	13.3	39.8	286.2	(Averages)
			GROUP VI				
			(300-400 Cases)				
88.5	8.52	1.31	2.63	8.5	25.92	305	
66.0	16.0	....	18.0	....	....	328	
50.0	43.0	5.0	7.0	10.0	36.0	360	
80.0	4.0	12.0	16.0	10.0	38.5	385	
95.0	0	0	5.0	10.0	30.0	300	
87.5	8.0	....	4.5	8.0	32.0	400	
467.0	79.52	18.31	53.13	46.5	172.42	2,178	(Totals)
77.8	13.25	4.77	8.85	9.3	34.48	363	(Averages)
			GROUP VII				
			(400-600 Cases)				
70.32	25.49	4.5	4.29	7.0	40.8	583	
86.0	14.0	2.6	0	12.0	63.8	532	
67.0	17.0	5.0	16.0	20.0	100.0	500	
223.32	56.49	12.1	20.29	39.0	204.6	1,615	(Totals)
74.44	18.83	4.0	6.76	13.0	68.2	538	(Averages)
			GROUP VIII				
			(600–1,500 Cases)				
73.0	16.0	0	11	3	22.5	750	
80.0	15.0	10.0	5	9.8	100.0	1,020	
77.5	12.5	7.5	10	10.0	150.0	1,500	
230.5	43.5	17.5	26	22.8	272.5	3,270	(Averages)
76.8	14.5	5.8	8.6	7.6	90.8	1,090	(Totals)

relieved of hospitalization, with its attending expense, along with the mental anguish of an approaching operation. Then, again, should operation be deemed imperative, after irradiation, there can be no contra-indication to such a procedure. But if care is exercised in selecting goiter cases for irradiation, there will seldom be need for operative interference. We believe from general observation that there is indication for the use of surgery in certain types of goiter; we are also convinced that, if radiation therapy were used whenever it is indicated, many lives would be saved and a very large percentage of such cases cured.

This report is a convincing demonstration of the fatuity of the notion existing among certain members of the medical profession, that radiation therapy will allow itself to be overlooked in the treatment of certain types of goiter. On the contrary, we have irrefutable proofs of its efficacy in the treat-

ment of thyrotoxicosis, and we are hopeful that the medical profession will soon realize its merits in a more general way.

REFERENCES

(1) MacLean, N. J.: Thyroid Disease. Canadian Med. Assn. Jour., December, 1922, XII, 847-853.
(2) Cooke, A. B.: Present Status of Thyroid Surgery. California and West. Med., April, 1929, XXX, 263.
(3) Mayo, C.: Jour. Am. Surg. and Gynec., June, 1904, XVII, 199.
(4) Nordland, M., Hall, B. E., and St. Cyr, K. I.: Air Embolism in Thyroidectomy, with an Animal Experimental Study. Western Jour. Surg. and Gynec., August, 1931, XXXIX, 581-591.
(5) Bardachzi, Franz: Zur Röntgenbehandlung der Basedowschen Krankheit. Strahlentherapie, 1930, XXXVI, 173-178.
(6) Schwarz, G.: On the Roentgen Therapy of Basedow's Disease. Strahlentherapie, 1928, XXX, 613-618.
(7) Meyer, W. H.: Roentgen Therapy in Hyperthyroidism; Report of 328 Cases of Thyrotoxicosis Subjected to X-ray Treatment. Med. Jour. and Rec., Feb. 1, 1928, CXXVII, 137-141.
(8) Holzknecht, Guido: The Roentgen Treatment of Morbus Basedowii. Radiology, February, 1930, XIV, 139-144.
(9) Soiland, A., Costolow, W. E., and Meland, O. N.: Radiation Therapy in Hyperthyroidism. California and West. Med., December, 1927, XXVII, 789.
(10) Holzknecht, Guido: Roentgen Therapy of Basedow's Disease. Strahlentherapie, 1928, XXX, 605-612.

Measurement of Electron Rays is Improved. The methods of measuring the powerful Lenard or electron rays have been perfected by an investigation of Dr. Lauriston S. Taylor, of the United States Bureau of Standards.

Lenard rays are obtained by pushing electrons through a vacuum tube under a pressure of several hundred thousand volts. By use of a small window of metal or glass the speeding electrons can be obtained in the air outside of the tube. As they have been used, since their first production in large quantities by Dr. W. D. Coolidge, for a great variety of chemical and biological purposes it is important to have an accurate method of measuring them.

Three methods of measuring the rays were compared. Of these the use of a "Faraday chamber" was found to be most effective. This consists of two metal chambers enclosed one within the other and having openings through which the electrons may pass to the inner chamber.

The alternative methods are by means of an open plate or by means of a condenser. The open plate results were too low, but always in a constant ratio to the Faraday chamber measurements. The condenser method gave results that did not agree with the Faraday chamber results.

The difficulty of making this measurement lies in the fact that the swift electrons striking a metal surface set free other electrons so that the total amount of electricity cannot easily be obtained.—*Science Service.*

THE RADIUM TREATMENT OF TOXIC TYPES OF GOITER[1]

By D. T. QUIGLEY, M.D., F.A.C.S., OMAHA, NEBRASKA

THE difference between the types of goiter amenable to radiation treatment and all other types lies in the fact that those in which radiation has proven to be of value are the types accompanied by an increased functional cell activity. In most of these cases there is also a proliferation of cells. Therefore, the problem presented is the problem of reducing the amount of secreting epithelial surface, whether it be contained in an adenoma or in a thyroid hyperplasia. We have also the problem of reducing the degree of hyperactivity of individual cells.

There is an optimum point in thyroid secretion. Departure from this point, either upward or downward, leads to disease. While a small increase in thyroid secretion heightens all the vital powers and functions, a greater degree of increase has a profoundly poisonous effect on all body structures, these effects being particularly noticeable in the nervous system, the brain, and the glands of internal secretion.

In dealing with hypothyroidism or hyperthyroidism, we are dealing simply with a departure from normal quantity in the secretion of the thyroid, the departure being either a lack of the necessary secretion, or an over-supply of the same secretion.

In dealing with adenoma of the thyroid, we have introduced into the equation quite a different factor. We have here to deal with an increased activity of thyroid tissue, but the thyroid tissue in question is not normal. It is a more or less abnormal structure growing inside of a capsule, which, in turn, is inside of a thyroid gland. The tumor tissue produces a secretion which is incomplete, or otherwise abnormal in its manufacture. To a certain degree, it imitates normal thyroid secretion, but it exerts a more poisonous effect owing to the fact that it is not only excessive in amount, but it is also abnormal in chemical make-up. We have here to deal with a question of quality as well as quantity.

In dealing with toxic thyroid, we are dealing with both increased proliferation of cells and increased activity of these cells. Such physiologic behavior suggests an irritating factor in the etiology of the disease, the search for which has been going on for many years. The knowledge now at hand, the most reasonable working hypothesis, is that micro-organisms brought into the gland through the blood, or lymph vessels, and acting directly on the thyroid epithelium are the principal etiologic factors. It is possible that the overgrowth of thyroid tissue may, in some degree, be compensatory. Thyroid secretion combats toxins and infections. An abnormally high amount of material, emanating from foci of low-grade infection, may call out an extra effort on the part of the thyroid infection-fighting mechanism and this, in order to protect the body as a whole, may lead to the overgrowth of the secreting epithelium which has this protective effect. If this theory is correct, then radiation is the treatment of choice because it has the effect of inhibiting, or, in larger doses, actually killing the hyperactive and hyperproliferating cells, and also of killing certain low-grade infections. Except in extreme cases, surgical removal of the offending exophthalmic goiter would then be contra-indicated. On this same theory, the surgical removal of thyroid adenoma would be indicated owing to the fact that the secretion here is poisonous, even in small amounts.

[1]Read before the Radiological Society of North America at the Seventeenth Annual Meeting, at St. Louis, Missouri, Nov. 30–Dec. 4, 1931.

A factor which must be considered in all goiter work is iodine supply. The secretion elaborated by the thyroid contains iodine. In the absence of sufficient quantities of iodine, the thyroid enlarges in order that a greater number of cells may be put to work to recover iodine from the circulating blood.

The relation between iodine content in food and goiter is well known. The countries in which the soil, and, therefore, the vegetables, are deficient in iodine always carry a high goiter incidence. Those in which iodine is plentiful have relatively few cases of goiter. An example of the latter is the State of South Carolina, which has the highest iodine content in the soil and, therefore, the highest iodine content in the vegetables produced. This State has the lowest goiter incidence.

Goiter is common in valleys which receive little sunshine, such as the narrow valleys in the Swiss Alps. The same thing is true of the mountain valleys in Montana and Wyoming.

Districts in which cistern water is used, instead of well water, have a high goiter incidence. Cistern water contains large numbers of colon bacilli from the deposits made by birds on the roofs of houses. On the prairies of the Dakotas, Minnesota, Michigan, and Wisconsin, we find abundant sunshine, but a deficiency in iodine. These areas produce many cases of goiter. But the goiter incidence is markedly increased here in the districts in which cistern water is used, for, in addition to the patient's experiencing iodine starvation, the upper part of the alimentary canal is exposed to colon bacilli.

We find, then, three factors contributing directly to goiter incidence: (1) iodine starvation; (2) lowered resistance to infections in general on account of deficiencies in food and sunshine; (3) exposure of the upper part of the alimentary tract to water containing colon bacilli.

The toxic types of goiter are, undoubtedly, more common than is generally supposed. Many of these present no tumor mass and are due to an excessive activity; or some little tumor mass is present, but is concealed in the upper part of the chest or behind the sternum. In over-fat persons, it is very easy to fail to discover enlargements, even of normally placed thyroids. These may be located, however, by means of the X-ray.

Toxic conditions of the thyroid are usually accompanied by a high degree of irritability of the nervous system. The patient is nervous; his hands are shaky, and, while he eats large quantities of food, his muscular strength is decreased. His eyes may or may not become more prominent and he may exhibit many symptoms which border on insanity. The whole symptom complex goes through periods of exacerbation followed by periods of quiescence. Each flare-up of symptoms, however, usually becomes a little more severe than the one preceding it. In the later stages of the disease there are no remissions and the symptom complex constantly increases in severity, until death by heart failure occurs.

The action on the heart is, perhaps, the most important effect produced by toxic goiter. It is well known that, in the mortality records, heart disease leads all others by a good margin as a cause of death. It is problematic how much of this mortality may truthfully be attributed to disturbances of the thyroid gland. There is no question but that many diseases diagnosed by physicians as various forms of primary heart disease are, in reality, secondary effects upon the heart produced by thyroid disease. A more general use of basal metabolism tests would uncover the truth in a large number of these cases; however, basal metabolism tests will not completely clear the situation. X-ray films to discover hidden goiters, a more careful examination of patients, and better co-ordination of symptoms and signs

must be the rule if the thyroid hearts are to be separated from other forms of heart disease. If the large number of thyroid hearts which operate as causes of death are removed from the list of heart diseases and placed in the category of thyroid disease, where they belong, not only would the mortality records show an improvement in the situation as regards heart disease, but also many cures might be effected in these cases of thyroid disease. Thus the mortality records in both heart and thyroid diseases might be very much bettered.

In exophthalmic goiter, the ideal therapy is that which directly reduces the number of proliferating, secreting cells and reduces the activity of the cells which remain. If this therapy also carries a direct killing effect on low-grade micro-organisms, then it leaves little to be desired except the clearing out of foci of infection which may be feeding micro-organisms into the diseased thyroid.

In the surgical treatment of the disease, nothing is accomplished except the mechanical removal of the over-secreting and hyperplastic mass of cells. The area of thyroid tissue which remains after a surgical operation is likely to go through the same kind of hyperplasia again, because the cause of the disease has not been removed. Clinically, the truth of this is shown far too often and we occasionally see cases in which exophthalmic goiter has recurred many times.

CASE REPORTS

In 1916, the author treated his first patient with radium—a woman who had already submitted to three operations for recurring exophthalmic goiter. Following the last operation, the goiter had, in a period of three months, recurred to its original size and severity. A dose of 150 mg. was administered over the enlarged thyroid in three 3-hour treatments, the treated area being changed so that the whole area was evenly irradiated. After waiting a period of three months, in which time the patient showed definite signs of improvement, the treatment was repeated. It was again repeated after another three-months period. The size of the enlarged gland was very materially reduced, the symptoms disappeared, the prominent eyes became somewhat less prominent and, since the time that this treatment was given, the patient has been well.

During the same year, a patient was treated who was considered to be in a dying condition from heart disease. She was 24 years of age and had a history of having been ill with heart symptoms, rapid pulse, and muscular weakness for several months. She had been confined to bed for four and a half months. She had consumed quantities of digitalis and other heart medicines. The woman was very much emaciated, exceedingly nervous, and mentally in a condition approaching mania. As she lay in bed, it was noticed that she had a rather prominent swelling in the region of her thyroid and I suggested the application of 60 mg. of radium heavily screened over the swollen thyroid. The application was made for a period of 13 hours. Three weeks later the patient was much improved. Her pulse, which had been so rapid that it could not be counted, had come down to 120. Her muscular strength was so much better that she sat up in bed. Her mental condition was clearer. At this time another application of 60 mg. of radium was applied for 13 hours. Three weeks after the second application the patient was able to be up in a chair, and from that time on her progress was continuous. After three months, she was given another treatment. At this time she expressed a desire to resume her occupation as school teacher, but she was advised to rest for one year. During this year she was married. Now, 15 years have

elapsed since her treatment. During these years she has had no recurrence, although she has experienced very severe mental strain. Her husband, a banker, was imprisoned for two years following the failure of his bank. The patient went through these periods of strains and stresses and is now back at her old occupation, teaching school, without any recurrence of her hyperthyroid symptoms.

In 1917, during the war hysteria, a farmer's wife presented herself with all the symptoms of an advanced exophthalmic goiter. Her troubles were accentuated by war conditions. She was obliged to take care of five small children, the animals about the farm, do the milking, the churning, and other necessary duties. Her position was almost intolerable. She was kept in the hospital three days and 120 mg. of radium applied separately over each lobe of the thyroid and the isthmus. She was instructed to rest three months, no matter what the cost might be, as her weakened heart could not possibly withstand a continuation of the strains to which it had been subjected. Four months later she returned, apparently well, and having gained several pounds in weight. I suggested to her that the rest had probably been the principal factor in her recovery. She replied that she had taken no rest, and, not having been able to secure help for either the farm or the house, had carried on her work exactly as before her treatment. The improved condition could be attributed to nothing but the radium treatment. As there were some nervous symptoms and rapidity of pulse still apparent, she was given another treatment, remaining in the hospital a day and a half. We did not see this patient again until four years later, when she came to the city. As she had remained well, no other treatment was used except the removal of two crowned dead teeth which we presumed might have had some etiologic relationship to the goiter.

In 1918, a woman, 45 years of age, came from a small town in South Dakota where cistern water was used for drinking purposes. The well water in this neighborhood was contaminated with more or less iron which gave it a bitter taste, and, on drying, produced a red precipitate. This sediment convinced the inhabitants that the well water was unwholesome. The woman had a moderately enlarged thyroid gland with all the signs and symptoms of exophthalmic goiter. Her thyroid was irradiated and an infected maxillary sinus drained. This, with a three-day stay in the hospital, started her on the road to recovery and in three months her symptoms were entirely cleared up. She has remained well since then. She was instructed to discontinue the use of cistern water.

In the latter part of October, 1920, a post-office employee, 40 years of age, was referred by an Omaha physician for treatment for exophthalmic goiter. The thyroid was very much enlarged, presenting a mass like a collar encircling both sides and the front of his neck. His pulse was 140. He had applied for relief to his physician, because he had found that his muscular strength was failing to such an extent that he could hardly continue with his work—loading heavy mail sacks on to trucks. This patient was extremely nervous and shaky. Owing to the fact that he had a large family and a small income, he felt that he could not afford to give up his work and enter the hospital for an operation. He was given a radium treatment which consisted of the application of 120 mg. of radium, screened with 1 mm. of silver and 1 mm. of brass at a distance of 2 cm., for 20 hours over each lobe and for the same length of time over the isthmus. After six weeks this was repeated, but with half the amount of radium used in the first treatment. The patient, who kept on with his work, received no other treatment except that two

badly diseased teeth were removed. During the months of November and December, his work increased very materially on account of the Christmas rush, but during this time he was able to continue without intermission. It was felt at the time that the situation, putting an extra strain on his heart muscle as it did, would lead to a permanently damaged heart; however, nothing of this kind has developed. The patient has kept on at the same work during the 11 years intervening and at the present time is apparently well.

In my experience, favorable results, which may be comparable with results obtained by surgical operation, have been obtained in approximately 70 per cent of the cases treated. We have found that the cases which do not respond well to treatment by surgical operation and that recur after surgical operation usually respond well to radium radiation. On the other hand, cases which fail to show good results following radium treatment are usually good cases for surgery. I do not know of a case that has been properly treated with radium radiation, even though the radium radiation has been unsuccessful in controlling the symptoms, that has recurred following a subsequent surgical operation. Apparently the radium radiation reduces the likelihood of recurrence, or prevents it altogether. Radium treatment, then, helps to make surgery more efficient in this particular class of cases. In those unsuccessfully treated cases that have been followed to the operating room, there has been no increase in the difficulties incident to the removal of the goiter. No adhesions have been noticed in any case, but in many of the diseased glands that have been subjected to radium treatment an increased hardness has been noticed, due to the production of considerable amounts of connective tissue. The firmness and hardness which occur in some of these irradiated glands probably make it easier for the surgeon to remove the diseased tissue, because it does not collapse under his fingers like ordinary thyroid tissue.

During the period between 1915 and 1927 we have treated 137 cases. No account is taken of cases since 1927, as we believe that sufficient time has not elapsed in the latter to justify recording the results at this time. This group contains 18 patients treated as charity patients and in the University Hospital and 119 treated in private practice. Of the University Hospital and charity patients, 12 were subsequently recommended for surgical operation. Only five responded successfully to the radium treatment. One left the hospital without completing the treatment. Of the cases treated in private practice during the same time period, 83 were sufficiently improved so that subsequent surgical intervention has not been necessary; 35 have shown little or no improvement and have been referred for surgery. Some of these patients have since died from other diseases, some have been lost, and some have had satisfactory results from surgical operations. In the cases successfully treated with radium are 15 who had previously been operated upon, but in whom there had been one or more recurrences.

It will be noted that, in the University Hospital and charity patients, the percentage of satisfactory results was much less than among private patients. This may be accounted for by the fact that the University Hospital patients are generally paupers, poorly fed and poorly housed, it being impossible for them to secure good living conditions after they have left the hospital. The private patients, on the other hand, were well fed, well housed, and did not have to suffer from the mental stresses and strains incident to pauperism; on leaving the hospital, they went back to good homes and good food.

In the cases that show satisfactory results after radium treatment, the first symptoms

to show improvement are those of nervous origin. The patient's extreme nervous irritability becomes markedly lessened, usually within the first three days. Muscular strength is noticeably increased within the first week. Mental excitability is much improved after the first five or six days. The patient who has been on the verge of mania will appear calm and placid after two or three weeks. There is usually considerable reduction in the size of the thyroid gland. In some cases the gland has been reduced apparently to normal size. In many, the reduction in size is only partial. This, of course, is not satisfactory to the patient who wishes all objective evidences of the disease removed. The same thing may be said about the undue prominence of the eyes. In some cases, the eyes recover the normal appearance. Most maintain a certain degree of prominence of the eyes even after all other signs and symptoms of the disease have disappeared. Usually, however, it is lessened, but not completely reduced to normal. The diarrhea which accompanies some cases of goiter is usually improved early and the patient's ability to digest food is better. These patients are nearly all below normal weight. With an increased ability to digest food and a lessened oxidation, the weight increases. In no cases have I seen myxedema follow radium treatment. Apparently complete destruction of thyroid tissue is not possible with radium as long as the metal screening and the distance are correctly estimated and the dose is kept within reasonable limits.

In regard to toxic adenoma, the results with radium have not been so satisfactory as with exophthalmic goiter. The percentage of cases requiring subsequent operation is approximately 50. The cases of adenoma that respond show the beneficial effect very quickly, so that, if it is desired to use the therapeutic test on such a patient, ten days or two weeks will show whether it is better treated by radium radiation or surgery. In such cases, no skin burn which might interfere with surgical operation need be produced.

It is probable that in some cases there also exists, in some degree, coincident disease involving the parathyroids. In no case in our group has any injurious action on the parathyroids been noted. This fact should be considered in connection with the possibility of accidental removal of the parathyroid, which sometimes occurs during surgical operation.

The destructive action of radium radiation on the diseased tissues seems to be present in both toxic adenoma and exophthalmic goiter. The percentage of actual cures is much higher in exophthalmic goiter because here we are simply inhibiting excessive activity. In adenomas, the actual destruction of tumor tissue by the radiation is necessary. In both adenomatous and exophthalmic goiter cases we occasionally perceive unusual symptoms which seem to indicate that both hypothyroidism and hyperthyroidism are present. Even in these cases the radium radiation seems to help to restore normal balance. This is probably due to the fact that the radiation kills low-grade infecting organisms of different types, some of which are stimulating and some of which are inhibiting to the particular epithelium in which they happen to lodge. Thyroid secretion is, undoubtedly, a complex product that may carry simultaneously certain potent elements in hyper- and others in hypo-quantities.

Some cases of exophthalmic goiter are accompanied by persistent thymus. In these it is necessary to irradiate the thymus as well as the thyroid. Care must be taken not to mistake a persistent thymus for a substernal goiter. Here a therapeutic test may make clear the diagnosis, as a thymus always shrinks very quickly after radiation,

while the substernal goiter requires operation. Patients with persistent thymus invariably present an unnaturally youthful appearance, seeming to be from 10 to 15 years younger than their real age.

In this series of cases we have included no cancers or other neoplasms of the thyroid—except toxic adenoma—no cysts, anomalies, or any of the various kinds of thyroiditis.

Patients who have made a successful recovery from goiter must be careful that a relapse does not occur, no matter what form of treatment may have been used. Not only must all foci of infection be eliminated, but other hygienic measures must be considered so that the general resistance to infection is kept at the highest possible point. Food must be considered from the standpoint of calcium, iron, iodine, and vitamin content. Starvation for any particular vitamin of the protective group, A, B, and C, is very likely so to reduce the whole infection-fighting mechanism of the body as to render the patient the victim of deficiency diseases which invite infections, and may thereby help to reproduce the original thyroid disease.

Fourteen Points Govern Building of Atom Cores.—Fourteen points for the government of the atom nucleus have been formulated by Prof. W. D. Harkins, University of Chicago.

Physicists will be aided in their search for the secret of the atom nucleus by these rules. The stability and formation of the ninety-two elements of the chemist's periodic table of atoms are intimately governed by them. They relate particularly to the atomic weight and the atomic number, or order number of the element in the table.

Nature is most often even in making her atom cores, Professor Harkins finds. Nearly all atomic nuclei contain an even number of electrons. The atomic number and the number of protons in the nucleus are generally even, too.

Elements of even atomic number, the newest data indicate, are ten times more abundant on the surface of the earth or on the sun. In meteorites the atom nuclei of elements of even atomic number are fifty times more abundant. —*Science Service.*

THE PREVENTION OF HYPERPLASIA OF THE THYROID IN THE OPOSSUM BY X-RAYS[1]

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THE experimental literature, which we reviewed in a previous article (1), shows that *normal* thyroid tissue is resistant to X-rays. The clinical literature reveals practically nothing concerning the effect of X-rays on the hyperplastic gland but does indicate that X-ray treatment benefits, at least temporarily, some 60 per cent of patients afflicted with hyperthyroidism. No observations have been made to ascertain if X-rays may prevent hyperplasia.

Bensley (2) has shown that, if opossums, when confined to cages, are fed a high protein meat diet, the thyroid undergoes marked hyperplasia which is quite evident in two weeks. He could not prevent this hyperplasia with iodine, but it did cause the hyperplastic gland to store colloid. Hence, we had at hand a method for determining if X-rays may prevent hyperplasia of the thyroid.

METHODS

Dosage.—The same dosage used in our previous study (1), which was used by B. H. Orndoff, for the treatment of hyperthyroidism, was employed. For our equipment the factors were as follows: ma., 4; sphere gap, 130; peak, 177; filter, 0.25 mm. Cu plus 1 mm. Al; portal, 5×8 cm.; distance, 50 cm.; time, 55 min.; yielding 385 r units. One series consisted of one dose given at weekly intervals for four weeks (four doses). A month was allowed to elapse before a second series was given.

Experiments.—Sixteen opossums were obtained from Texas. One was killed on the day of arrival and the thyroid which was removed, weighed, and examined histologically was found to be normal. Eight were treated with X-ray, seven being used as controls. Three of the eight (Lot 1) treated were started on meat and X-ray treatment at the same time. The other five (Lot 2) were started on meat immediately after the conclusion of the first series.

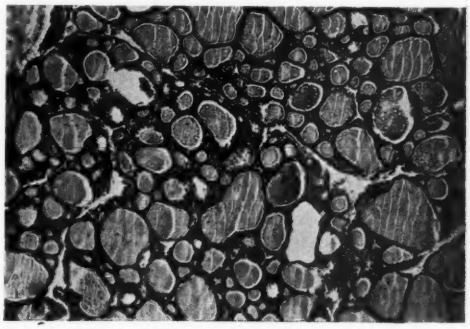

Fig. 1. Normal thyroid of opossum on receipt at the laboratory and before meat diet. Magnification 60 times.

RESULTS

Since Bensley found that the thyroids were normal on receipt of the opossums and remained so when the animals were kept on a proper diet, we sacrificed only one of our opossums to determine the state of the thyroid on coming into the laboratory. It was found to be normal and a section of it is shown in Figure 1. The average weight of the glands of nine opossums, found by Bensley to be histologically normal, was 157 milligrams.

Lot 1.—In this lot, X-ray treatment was started at the same time as the meat diet. A study of Table I shows that the glands of the controls, the animals that received meat but no X-ray treatment, were markedly hyperplastic. Follicles were rare. The measurements show that the glands were

[1]Read before the Radiological Society of North America at the Seventeenth Annual Meeting, at St. Louis, Nov. 30–Dec. 4, 1931.

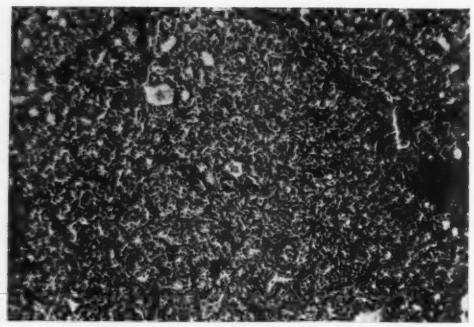

Fig. 2. Hyperplasia of thyroid of opossum (13) induced by a meat diet, serving as a control to the X-ray treated thyroid in Figure 3. Magnification 60 times.

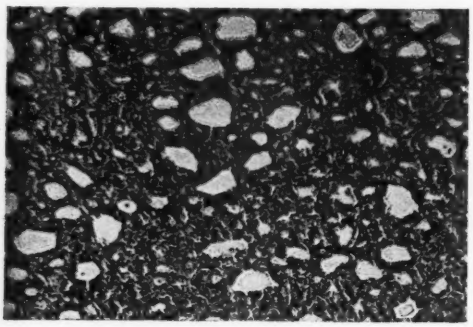

Fig. 3. Showing the thyroid of an opossum (65) on meat diet that received two series of X-ray treatments. Hyperplasia has occurred but not to the extent as the controls on meat diet without X-ray. Magnification 60 times.

grossly enlarged, while the glands of the animals that received X-ray treatment were hyperplastic, but contained numerous small follicles. The measurements of the glands show that they were smaller than the controls.

Lot 2.—In this lot the meat diet was not started until after the first series of X-ray treatments. In general the results are the same as those obtained in Lot 1. The difference in the measurements of the treated and untreated glands corresponds with the weights (Table I). It is to be noted that the average weight of the untreated glands was 404 and of the treated 294 milligrams. Although the treated glands of Opossums 62 and 63 weighed as much as the untreated, the histologic picture was quite different (Figs. 1 and 2).

Epilation of the hair of the neck occurred in all opossums which received two or more series.

These results show that X-rays in the dosages used prevent, to a considerable extent, the hyperplasia of the thyroid gland of the opossum induced by a diet rich in meat. It is possible that, had we reduced the amount of meat fed and used larger doses of X-rays, the hyperplasia might have been entirely prevented. However, we suspect that, if we had done this, our results would have been more variable and difficult to interpret.

These results support the clinical effectiveness of X-ray treatment of the thyroid gland in some cases of hyperthyroidism and indicate that the reason for failure in others is due to an insufficient amount of X-ray treatment to combat the marked tendency to hyperplasia in these particular cases. Our results suggest the possibility that X-ray treatment may be of benefit in preventing recurrences following subtotal thyroidectomy and that X-ray treatment may be a valuable adjunct to iodine medication in bringing about involution.

This work is now being continued on rabbits in which thyroid hyperplasia can be induced by feeding cabbage (3) and in which metabolic studies can be readily made.

CONCLUSION

The hyperplasia of the thyroid gland that occurs in opossums on a high protein (meat) diet was definitely decreased, but not entirely prevented, by the X-ray dosages employed.

BIBLIOGRAPHY

(1) Walter, O. M., Anson, B. J., and Ivy, A. C.: Radiology, January, 1931, XVI, 52-58.
(2) Bensley, R. R.: Am. Jour. Anat., 1916, XIX, 57.
(3) Chesney, A. M., Clawson, T. A., and Webster, B.: Johns Hopkins Hosp. Bull., November, 1928, XLIII, 261-277; 278, 291.
Marine, D., Baumann, E. J., and Cipra, A.: Proc. Soc. Exper. Biol. and Med., June, 1929, XXVI, 822-824.

TABLE I (LOT 1)

Serial number	Disposal of animals	Measurement of glands (millimeters)			Dosage (series)	Diet-period	Histologic condition	Histologic observations
		Length	Breadth	Depth				
Controls								
1	Fresh P. M.	20 20	4.5 5	....		3/1-7/26	Fair. Epithelial desquamation	Hyperplastic.* Follicles rare and small.
2	Killed	24 19	10 10	....		3/1-8/4	Similar to No. 1	Hyperplastic. More vascular than No. 1.
3	2 hrs. P. M.	18 22	9 8	8 6		3/1-8/8	Poor	Hyperplastic. Few follicles present. Vessels engorged.
4	Killed	16 22	7 8	....		3/1-10/6	Good	Markedly hyperplastic. Small follicles common. (Like No. 13, Lot 2.) One gland very vascular. General picture: cord-like masses or small follicles pressed upon by engorged capillaries.
Treated								
24	Killed	13 11	5 6	....	3	5/1-10/6	Good	Hyperplastic, but small follicles numerous; a few large (similar to No. 61 of Lot 2).
51	12 hrs. P. M.	7 6.5	4.5 4	....	1½	3/1-6/6	Poor	Somewhat follicular.
55	Killed	13 17.5	7.5 9	4 3.5	2	3/1-7/13	Good	Hyperplastic, but small follicles fairly numerous (similar to No. 24, above; and also to No. 61 of Lot 2.

*The hyperplastic thyroid gland presents, in sections, a highly cellular, as opposed to a follicular, appearance. The colloid-filled follicles of the normal gland tend generally to be replaced by masses of cells which may assume a cord-like arrangement. Such smaller follicles as remain contain little or no colloid and possess reduced lumens bounded by epithelial cells which show a distinct increase in size over that of the cells in an unaltered gland.

TABLE I (LOT 2)

Serial number	Disposal of animals	Measurement of glands (millimeters)			Weight milligrams	Dosage (series)	Diet-period	Histologic condition	Histologic observations
		Length	Breadth	Depth					
Controls							Not dieted	Good (Fig. 1)	Unaltered follicular structure.
11	Killed day of arrival	11	4	....					
10	Killed	12.5 24	5 5	3 5	445		1/7-3/12	Good	Reduced number of follicles; hyperplastic.
13	Killed	15 13	6 7	4 4	380		1/7-3/19	Good (Fig. 2)	Further reduction in number of follicles; hyperplasia more marked than in No. 10.
14	Killed	14 12.5	6 6.5	4	390 Av. 404		1/7-3/19	Good	Change intermediate between that of No. 10 and No. 13.
Treated									
61	Killed	12 12	7 5	4 2.5	230	2	1/7-3/19	Good	Moderately follicular.
62	Fresh P. M.	15 12	7 7.5	3.5 3	390	2	1/7-3/12	Fair	Similar to No. 61 above.
63	2 hrs. P. M.	18 15	5 5	3 3	500	1	1/7-1/17	Poor	Follicular—more so than other treated specimens.
64	6 hrs. P. M.	13.5 12	4 5	3 3.5	180	1½	1/17-3/18	Poor	Follicular—more so than other treated specimens.
65	Killed	10 14	5 5	2 3.5	170 Av. 294	2	1/17-5/2	Good (Fig. 3)	Follicular; more so than No. 61.

DISCUSSION

DR. W. H. OLMSTED (St. Louis, Mo.): On the one hand, we have the fact that the surgeons have obtained very excellent results from thyroidectomy and, on the other hand, the radiologists have as good results from roentgen therapy. The physician is at a loss to know which of these two therapeutic agents to use in the individual case he may be called upon to treat.

What are the indications for surgery and what are the indications for roentgen treatment? My experience has not been broad, so I cannot present to you hundreds of cases. Three years ago I began to treat a few cases of hyperthyroidism with X-rays, in association with Dr. Sherwood Moore; however, I cannot give you Dr. Moore's technic.

Some of the facts that our experience has taught us are as follows:

One treatment will reduce, on an average, the basal metabolic rate 10 per cent. It is, therefore, apparent that, with the technic we have been using, the patient with a very high metabolic rate would require six, or more, roentgen treatments. It is our belief that deep therapy should not be given more often than once every six weeks because of the danger of burns. If this be the case, it is apparent that to treat a thyroid patient with a very high rate requires a great deal of time. If he is to have six treatments, it will require 36 weeks to give the treatments. For these reasons we believe that roentgen treatment is adaptable only to those cases which show an increase in their basal rates of not more than 40 per cent. In such patients, one can safely delay treatment. It is also the best therapy in the mild case of hyperthyroidism, because there is less likelihood of a resulting myxedema when one uses the X-rays than when the surgeon is compelled to judge how much thyroid to remove.

A further group in which roentgen treatment of hyperthyroidism has been of particular use is that in which there are complications by other diseases such as diabetes, arteriosclerosis, and heart disease. In this group, we believe that roentgen therapy is of less risk than operation. However, I had one case, an old man who had had one stroke of apoplexy, presenting hyperthyroidism. He was given one roentgen treatment and died during the night following the treatment. I cite this case to show that roentgen treatment is not without some danger.

In conclusion, it seems to me that there is a place for roentgen therapy in the milder types of hyperthyroid cases, especially in those which are complicated by the presence of diabetes, heart disease, or arteriosclerosis. Those cases which are more severe, with high metabolic rates, should have operation. In them, the danger of post-operative myxedema is very slight, whereas, in the milder cases, myxedema is apt to occur. There is a more definite tendency of the return of an elevation of the basal metabolic rate after roentgen therapy than after operation. One cannot emphasize enough the point that Dr. Bartlett has brought out: the necessity of following cases of hyperthyroidism for months, or years, after the treatment has been begun.

DR. O. P. J. FALK (St. Louis, Mo.): We have heard the radiologist state the mistakes the surgeon probably has made, and we have heard the surgeon state his position. It might not be amiss for us to enumerate a few ways in which we internists make mistakes.

In simple goiters with adenomas, the prolonged use of iodine may precipitate hyperthyroidism. A previously impalpable adenoma may become distinguishable, which, when the symptoms do not subside, often requires surgery. Boothby advises against the use of iodine, except pre-operatively, in all patients over 25 years of age. Morine states that all reactions may be avoided by the use of a maximum of 10 mg. daily for not over one month, or not more than 1 mg. daily continuously. When we realize that one drop of Lugol's solution contains 8.5 mg. of iodine, we readily appreciate how often this limit of safety is exceeded (one minim of syrup ferrans iodide contains 3 mg. of iodine).

Another medical error is failure to recognize the syndrome Lahey terms "apathetic type of hyperthyroidism." This comes on in middle or later life, lacks typical clinical signs, and is often characterized only by an unex-

plained weight loss, tachycardia, and myasthenia.

Another mistake is lack of realization of the potential menace, after the fortieth year, of an adenomatous goiter without hyperthyroidism. In these cases, hyperthyroidism frequently develops so insidiously that it may exist for a long time before the patient is aware of any symptoms.

Plummer has recently called attention to the frequency of this fact, as well as to the surprising frequency of malignancy of this gland, the ratio being 2.7 per cent of all the thyroids removed at the Mayo Clinic. However, we must remember that this proportion exists for the truly pathologic glands actually removed, and not for cases of thyroid adenomas which are asymptomatic, hence untreated.

As to the choice between surgery and the roentgen ray, in the uncomplicated case, the consensus of opinion unquestionably seems to favor removal. Yet we feel that roentgenotherapy has a very definite place in the treatment of cases when surgery is inadvisable or refused.

The treatment of thyrotoxicosis is a problem in which, in any individual case, adherence to fairly well established precedents must be tempered with sound judgment in the choice of procedure. Here again, the patient must be treated, and not the disease alone, for, in hyperthyroidism, the man the disease has is of equal importance with the disease the man has.

Inasmuch as our choice of procedure is necessarily bound to be influenced, to some extent, by our particular field of endeavor, our contacts, and experience, we must constantly keep in mind the limitations, as well as the potentialities, of any particular form of treatment.

The management of every thyrotoxic case is essentially a medical problem, because of the fundamental metabolic upheaval, the cardiovascular involvement, the neuropsychic upset, and the autonomic nervous system imbalance. Nevertheless we must realize, in the majority of severe cases, particularly of the toxic adenomatous type, the inadequacy of complete ultimate medical *control* of the situation.

The fundamental principles of medical treatment are recognized to be:

1. Bed rest and mental quietude.
2. High carbohydrate diet, with limitation of protein, and the elimination of caffeine.
3. Use of sedatives and judicious iodine therapy.

Among the more common medical errors in the management of thyrotoxicosis seems to be the indiscriminate use of iodine for unduly protracted periods and in unwarranted amounts. In thyroid disease, there are many untoward effects of iodine that are serious. The routine established in hyperthyroidism by Plummer and Boothby—from 30 to 40 drops of Lugol's solution daily as a purely preoperative measure—has apparently resulted in the widespread habit of giving large doses over long periods of time, as a medical treatment in all types of goiter. Many of the very cases ultimately most harmed improve so markedly the first two weeks that the treatment is often carried on to the stage of actual damage.

DR. JAMES T. CASE (Chicago): I have no definite convictions about the relative value of radiation and surgery. I have seen both methods used and noted failures in both.

I would like to make some remarks in relation to the palliatives which may be employed in tiding a thyroid patient over an emergency until such time as surgery may be employed. Dr. Bartlett mentioned these. I would like to recall what he said and thank him for the courtesy in underscoring radiation.

First I would name iodine medication, but not for long periods. I do not think there is any palliative that can be continued over a great period of time without danger to the patient.

I would put ligation next because, after ligation of the thyroid vessels, usually the superior, if surgery is contemplated it must be done within two or three months at the latest or else the good done by the ligation will have passed.

I then put radiation. We will have to con-

cede that it is useful as a palliative, as a means which will produce results lasting much longer than three months and possibly over a period of several years, amounting to a cure in a considerable percentage of cases.

I have had no experience with injections nor have I been associated with clinics in which injection methods have been employed. I had an experience with one case in which hot water injection had been used, but finally radiation was employed, apparently with good results, lasting something over three years. I do not know whether it was the hot water injection or the roentgen treatment that did the work.

I have never seen a myxedema resulting from irradiation. I had one patient with carcinoma of the thyroid who was referred for roentgen therapy before the wound was healed. A portion of the middle lobe had been removed to take the pressure off the trachea, so that the patient could breathe. She was then referred for roentgen treatment in the hope of accomplishing something. I gave her persistent treatments over 14 months, treating her with a series every three weeks. After this period the patient was apparently cured and I let her go. Now, 16 years have gone by and she is still alive and well. Ever since the basal metabolic method has been introduced I have had her metabolism estimated every year or two. It is approximately normal and has been so ever since we began the estimations. If I ever had a case that ought to have exhibited myxedema, that is the case. I also have a very strong impression, based on experimental work, that we cannot damage a normal thyroid very much by roentgen therapy.

I have had experience with six malignancies of the thyroid, as I remember *ex tempore*. Three of these patients are alive.

I think there are certain definite contraindications to radiotherapy. We have mentioned the economic reasons, with which we will all agree, for it is sometimes cheaper to do the operation and get the patient back to earning his livelihood. Second, impending heart damage may indicate immediate surgery. I do not think we are justified in waiting for a temporizing method to stop the damage that is going on when a surgical operation will stop it very shortly. I do not believe roentgen therapy is indicated when we are dealing with a large toxic thyroid. It is damaging both by size and by toxicity and should be relieved by surgery. I have not had any success in the roentgen treatment of substernal thyroids. Patients with small toxic goiters, not exhibiting serious heart damage, and whose economic situation permits it, are ideal subjects for roentgen therapy.

DR. E. L. JENKINSON (Chicago): Regarding what Dr. Richter said about "cure," I have tried to guard against using the word "cure." In most of the papers I have written on the roentgen treatment of thyroid disease I have tried to use "symptom-free," rather than "cure." I think as he does—patients may have the disease though they live fifty years.

I think I would prefer to treat a patient with a high metabolic rate rather than one with a rate of approximately 20. It has been our experience that patients with high metabolic rates have responded better than those with low rates. In older patients our results have not been good; in fact, I had rather not treat them.

Regarding mortality. Eight years ago we reported two deaths. There is no secret about it—these two patients died. They have been reported. To what death was due, I do not know. Following the second series, one patient became bronzed and died.

We have treated over 1,000 patients. Those patients did not come to me directly, but were referred by very competent internists on our staff. If the method had absolutely no virtue, no curative power, I do not think those men would have sent the patients for therapy.

DR. WILLARD BARTLETT (closing): I have nothing to add, except that this has been a wonderfully helpful and illuminating session. I value particularly the remarks of Dr. Case, because he has been both a radiologist and a surgeon.

DR. H. M. RICHTER (closing): I am afraid that oftentimes men fail to get together in dis-

cussions because they use different languages and they do not understand one another.

In my work, every patient who fails to get complete relief from thyrotoxicosis, whose metabolic rate fails to drop to, or below, normal, is passed as a failure. No case is passed as improved.

The basis for that attitude is the idea that the patient who is merely improved is still toxic, though less toxic than previously. He, therefore, is in the same need for proper medical or surgical care that he was when he came under treatment in the first place. The patient whose basal metabolic rate has dropped from +60 to +40 under treatment is still just as much in need of treatment as if it has risen from +20 to +40 without treatment. A rate of +40 in itself is indicative of the need for further treatment. The patient, therefore, must be regarded as toxic and his previous treatment a failure. I believe that patients treated by radiotherapy should be classified in the same way, and the group of so-called improved cases entirely eliminated, or, rather, transferred to the group of failures.

This is illustrated by the paper of one of the speakers who had treated some thousand cases by radiotherapy, with approximately 70 per cent cures and 7 per cent failures. There is a deficit of 23 per cent somewhere. It seems to me that that 23 per cent should be added to the 7 per cent, making a total of failures of 30 per cent. That is a crushing number of failures.

Dr. Plummer may be interested in the case reported by Dr. Phemister of a patient who had a high-grade thyrotoxicosis. He was operated upon two, or possibly three, times, the final operation disclosing only two tiny fragments of thyroid tissue. The patient finally died of thyrotoxicosis. At autopsy, no further thyroid tissue was found, though the autopsy had to be somewhat limited. In the present state of our knowledge it is simply impossible to explain such a finding.

DR. ALDEN WILLIAMS (closing): I do not think we need be surprised that the radiologist feels in a haze and scarcely knows how to evaluate his own statistics. He has only the one-sided view. Dr. Case, who is both surgeon and radiologist, has a two-sided view and he admits that he is not certain which is the better method of treatment for this condition.

I like very much Dr. Bartlett's choice of words and his attitude of friendly fairness. He did seem to make one little inconsistent remark, that the subthyroid patient was worth nothing to himself or to anyone else, also saying a little later that the milder subthyroids are the ones that stay well. There must be real subthyroids and mild subthyroids.

I perhaps did not hear distinctly when Dr. Richter quoted his statistics. I may be wrong —that he had just the two groups: the cases which were considered rehabilitated and the cases considered failures.

DR. RICHTER: All were failures that were not cures in Dr. Bartlett's definition. Every improved case was a failure.

DR. WILLIAMS: I noticed that you were looking at our improved cases and placed them in the failures, and you did the same with your own. In your failures, did you decide that from the elevated basal rate?

DR. RICHTER: Every patient was regarded as a failure whose metabolic rate was above +15, quite irrespective of other things at the time of the final report.

With that there was the clinical study of the patient. In these 18 cases, as I said before, if we did not absolutely include every case that showed this raised metabolism, we would exclude certain cases on account of the physical condition of the patient. Every such patient was a failure.

DR. WILLIAMS: Then I had in mind the subthyroid that follows the surgical work. Were any of those considered failures?

DR. RICHTER: At the start, I said I would confine my paper to thyrotoxicosis. If you amputate a leg for a carcinoma, though the patient would be a leg minus, he would be regarded as a cure. The patient who has, for instance, a residual pathologic condition—damaged heart—a damaged leg in the example

cited—that patient is not well when we get through but he has thyrotoxicosis—sometimes tetany, sometimes hyperthyroidism.

Myxedema is a different condition. I aim to secure a temporary hypothyroid state in patients who were thyrotoxic. Thyrotoxicosis is incompatible with the absence of sufficient thyroid to produce it.

DR. BARTLETT: Dr. Williams, I am sorry that I made an erroneous statement about thyroidism.

The patient who has done the best in the experience of our clinic is the one who ends up with a basal rate of perhaps from —5 to 0. Now there is no mistake in that statement.

The other class of patients to which I referred numbers those who have succeeded in living through a number of these crises of which Dr. Plummer has spoken, who have not died on the way and have finally, as Dr. Carter said, burned out—the heart has been so terribly impaired that the individual cannot get around; the liver, kidneys, and other organs have been so impaired that they do not function properly.

DR. WILLIAMS: Dr. Bartlett drew a different picture of his material from the rest of us and shows perhaps why we cannot get together, why our groups are different. I know that the material mentioned by the medical side did not seem to have the picture of such seriousness and there were no deaths or emphasis on severity in the radiologic group. That probably is the reason why it is hard for us to come to the same conclusion.

I think we can draw this conclusion: as Dr. Jenkinson says, the medical men who keep on sending thyroid patients to the radiologists must be satisfied with the improvement under roentgen treatment. The surgical men who keep getting cases from the medical men also must feel very contented with the work that they are doing.

I have noticed some of these very earnest surgical converts among my medical friends who never send me a case for radiologic treatment. They say, "Why, Doctor, I get results by referring my cases to surgery and why shouldn't I keep on?" And I would say that they should. So we are all trying to understand a very difficult problem.

SKELETAL DISTURBANCES AND ANOMALIES[1]

A CLINICAL REPORT AND A REVIEW OF THE LITERATURE

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THIS report is based on a series of personally observed cases of skeletal disturbances and anomalies. It includes cases of syndactylism, hypodactylism, polydactylism, one case in which the thumb had three phalanges, ectromelia, deficiencies of the fibula, absence of carpal bones, and fusion of carpal bones. I am including also cases of dyschondroplasia for reasons which will be developed in the body of the paper.

The literature, both American and foreign, abounds in clinical reports of similar cases, but there is so much confusion with reference to etiologic factors and so little attention paid by clinicians in their reports to the remarkable experimental and biologic studies of Dareste, Stockard, Bagg, and others that I am prompted to collate some of the literature.

The fantastic theories which have been offered, based purely on imaginative, nonexistent factors, should be discarded in favor of experimentally proved evidence such as that advanced by Stockard and Bagg.

Popular tradition holds to the theory of primogeniture. Macklin (29) presented conclusive evidence that the first-born is not more liable to show hereditary defects than are the other children. After a study of 1,050 cases of defective children, she found that of these only 295, or 28 per cent, were first-born.

It is true, I believe, that all defects and deformities can be shown to be hereditary if we accept biologic experiments as sufficient proof. The absence of such proof in a particular patient is probably due to our inability to obtain accurate information relative to his ancestry.

There are many theoretic explanations of the etiology of defects and deformities.

David Perkoff (33) mentions the following which have been advanced with reference to syndactylism:

1. Lesions of the fetal nervous system (Guérin).
2. External pressure and traumatism during pregnancy (Cruveilhier).
3. Embryonic amniotic adhesion (Lannelongue).
4. Amniotic loops or bridles (Dareste).
5. Reversion to early conditions (Darwin).
6. Osler thinks it occurs more frequently in children of syphilitic appearance.
7. Edwards states that it is a stigma of degeneration, occurring in persons of weakened intellect.
8. Goldman asserts that syndactylism may be regarded as an arrest of development, since during fetal life the fingers are bound together for a time by webs of varying extent, the thumb almost always remains free, and in most instances two fingers only, usually the third and fourth, are bound together.

This is typical of the clinical papers. Many theories are presented, but no definite conclusions are drawn.

In order to correlate syndactylism and other defects or skeletal disturbances, it must be remembered that in the literature the same theories of origin have been advanced for each.

Many defects and deformities may be found in the same individual; for instance, syndactylism is frequently associated with polydactylism, hypodactylism, and de-

[1]Presented before the Southern Surgical Association, White Sulphur Springs, Virginia, Dec. 8, 1931.

ficiences in certain of the long bones. Professor Oluf Thomsen, Copenhagen, considers syndactylism unassociated with polydactylism as evidence of "less radical disturbance of the normal development." This last statement may seem unrelated to some of the foregoing, and yet study of the individual cases will prove the necessity for considering the importance of Professor Thomsen's statement in the light of biologic experimental data.

In 1898, Cotton and Chute (11), reported three cases of congenital defects of the fibula, and they stated:

> The amniotic theory seems to explain all lesions pretty clearly. We cannot but accept it as at least the most plausible theory yet advanced. The origin of the typical deformity would be, then, as follows: between the fifth and the eighth week, pressure of a too tightly fitting amnion interferes with the development of the exposed fibula and the outer toe or toes of the exposed foot. Lack of space determines the bend of the growing tibia; the adhesion which produces the so-called scar is a result of contact of the most salient point of the tibia with the enveloping wall. The persistent lack of growth of the whole limb is probably a result of deficient vessels and nerves due to the early pressure, as well as of the disease.

Tubby (40) states that "absence of the radius or fibula, though rare, is more common than absence of the ulna or tibia." In discussing theories relative to congenital defects in long bones, Tubby cites Henry Ling Taylor:

> Taylor sums up two of the theories generally advocated: (1) the primitive fin theory of Gegenbauer, and (2) the amniotic theory.
>
> The second theory ascribes the anomalies to a mechanical cause, namely, the pressure of the amnion and deficiency of fluid at the time of development of the arms, namely, about the fifth week.

He, too, considers the amniotic theory the most plausible.

Whitman (45) states that congenital absence of the fibula is rare and gives a number of theories of origin. According to him:

> The cause of deformity, associated with absence of bone, may be either an original defect in the germ or it may be due to interference with its development. In some instances amniotic adhesions may be one of the predisposing causes.

In 1914, G. Potel (34) in a series of remarkable papers on congenital malformations of the limbs points out:

> All genuine malformations are of embryonic origin, namely, due to an original germinal error. The amnion may determine easily recognizable traumatic lesions, but has nothing to do with the pathogenesis of true malformations. The modifications of the initial embryonic type, known as malformations, are produced—no matter to what species the embryo belongs—according to two mechanisms: histogenic variation and disease.
>
> The primitive or plastic embryonic cells are endowed not only with an almost indefinite power of proliferation, but, moreover, they enclose the material for several differentiations; actually, at the onset, the material for all differentiations. When a modification of the medium or environment supervenes, the plastic cellular substance endeavors to adapt itself to the new vital conditions offered to it. It develops in an atypical manner, but what very distinctly characterizes this atypical evolution—this mutation of the primitive type—is the correlated initial adaptation of all the elements which enter into the constitution of the modified organ. In the case of disease of the plastic cellular material, the protoplasm undergoes a more or less complete disintegration. The cell may die or it may suffer; in the latter case, the disease lasts a certain time, the differentiations are diminished, modified, or even arrested. Gradually, recovery ensues and the phenomena of differentiation and proliferation

are restored. But the momentary arrest has resulted in a loss of equilibrium, a local modification, which will manifest itself at birth under the aspect of a malformation. A classification of the congenital deformities is difficult.

All the varieties of localized osseous dystrophies, in spite of their apparent complexity, may be grouped under three principal headings:

A. Developmental disturbances of the skeletal rudiments:
1. Ectromelias.
2. Hypertrophies.

B. Disturbances of segmentation:
1. Abnormal fusions of the segments.
2. Exaggerated segmentations.

Exaggerated segmentation, resulting in polydactylism, is a relatively frequent malformation. It may be said to be the prototype of the hereditary skeletal modifications. In certain observations, a thumb with three phalanges existed at the same time as polydactylism.

C. Axial deviation.

D. Superadded aberrant heteroplastic nuclei (osteogenic exostoses).

The various processes do not exclude each other and are even very often found associated in the same individual.

Bagg (2), discussing polydactylism, states:

Stockard and others have shown that a reduplication of embryonic parts may be brought about experimentally by a temporary arrest of embryonic development at a critical growth period.

When the growing apical bud of a twig is arrested in development by pinching or other methods, dichotomous growth occurs, and as a result the two adjacent axillary buds, quiescent during the supremacy of the apical bud, begin to develop 'twin' branches. Similarly, Stockard has produced a reduplication of parts and marked degrees of twinning in trout embryos by arresting the development at a critical growth period.

Tubby (40), discussing polydactylism, states:

The condition is often hereditary and may be traced through several generations, and frequently exists both in the toes and in the fingers.

It is difficult to speak of types, as the individual cases vary so much, but the most frequent form is a supernumerary little finger. Next to that is a double thumb, or pollex duplex. Sometimes the additional thumb possesses three phalanges.

The last statement is of particular significance because anyone who has studied the human hand and foot has noted that the metacarpals and metatarsals of the first digit, or thumb and great toe, have their epiphyses at the proximal end, while the epiphyses of the other metacarpals and metatarsals are found at the distal extremity.

One of the cases in this group presented a first digit with three phalanges; this I originally considered an accessory index finger. The patient had a definite syndactyl condition of the first and second digits, and for this reason I do not know whether the musculature is that of the thumb or an index finger. Details of the case are included in the clinical section of the paper.

Observations similar to this have been made by Potel, Tubby, Windle, Struthers, and others. The most extensive study of this "anomaly" was made by Windle as long ago as 1892. He collected in all twelve cases, including his own. Because of the importance of the unsettled question of whether or not the thumb has, like other digits, three phalanges, the metacarpal disappearing in development, I am going to quote extensively from Windle's original paper.

Windle's patient had "five fingers and a thumb on one hand, and five fingers and no thumb on the other" (47). He found the following condition: The thumb on the left hand bore, on the radial side of its metacar-

pal bone, a supernumerary digit provided with a well formed nail. This digit had two phalanges, one of which articulated with the metacarpal bone. The thumb itself was nearly as long as the index finger, the appearance of which it simulated, and was provided with a metacarpal bone and with three phalanges, movable articulations existing between each of the members. The digit in question, though simulating the appearance of the other members of the series, was yet functionally a thumb.

Windle was able to find twelve such cases in the literature reported by Struthers, Rudenger, Otto, Gegenbauer, Wenzel, Gruber, and Annandale. These cases are abstracted by Windle and anyone interested in the subject may well review the original articles.

In his discussion of the nature of the three-phalanged pollex, he says:

It will be observed that the three-phalanged pollex may exist (1) alone, representing the normal pollex, or (2), with a supernumerary pollex. In the latter case both pollex and supernumerary, or prepollex, may possess three phalanges. It will also be noted that, as in polydactylism, the influence of heredity is met with in several of the cases.

At the outset, we are met with the question as to whether these three-phalanged digits should be considered as of the nature of thumbs or not.

It will be noticed that in twelve cases the three-phalanged digit replaced the normal pollex and functioned as a thumb, being, in the instances in which any note is made of the fact, opposable to the other digit. To call such a digit an instance of a double index with (presumably) absent pollex, is, to my mind, a misuse of terms, unless, indeed, we are to confine the term 'pollex' to a two-phalanged digit, a limitation for which I can see no justification. A consideration of the musculature in cases of double pollex will, I think, establish the fact that these digits are much more of the nature of pollices than of that of the other digits.

His conclusions are:

1. That the three-phalanged pollex, when existing in a pendactylous manus, is not an example of duplication of an ordinary digit, but is a true thumb.
2. That the musculature shows that, in cases in which there is an additional digit on the radial side, it and the digit next to the index both partake of the nature of thumbs, and may be looked upon as the first and second digits of a heptadactylous manus.

We note also from Windle's work that he quotes Struthers, who believes that the metacarpal or metatarsal, respectively, has disappeared and that the normal condition is that the thumb has three phalanges. Struthers says:

The facts in comparative osteogeny show that the position of the epiphysis is decisive in establishing the view that the bone which is wanting in the human thumb and great toe, and in the internal digit of other five-toed mammals, is the metacarpal and metatarsal, although custom and convention lead us to apply these terms to the bone which, homologically, is the proximal phalanx.

Continuing with our study of cases representing skeletal disturbances and anomalies, we note that the hereditary character of congenital disturbances such as syndactylism, polydactylism, and deficiencies of particular bones is evident from the literature. The question of whether it represents a dominant or recessive character has been investigated clinically by Snyder (35). His evidence points to a definite recessive factor for polydactylism.

He says:

During the Summer of 1928, in connection with an intensive study of human blood groups, a large number of negroes in Pamlico County, North Carolina, were found, who showed an extra fifth finger on each hand.

Careful family histories were gathered, and the results are presented herewith.

If one parent is polydactylous and the other normal, polydactylous children should make up at least half, and probably more, on the average, of the offspring, if the character is dominant. From 16 such matings, 24 polydactylous and 26 normal children are recorded. This is a slight bit of evidence for recessiveness. Two families are recorded in which, although one parent was polydactylous, all of the children were normal (in one case four, and in the other six); these are further indications of recessivity.

Summing up the evidence for recessiveness, the character does not fulfill the requirements for dominance (must occur in every generation; must show up on the average in half or more of the offspring), while it does meet the criteria for recessiveness (must be homozygous when it appears, as evidenced by the result of mating two individuals showing the character, may skip one or more generations and appear when neither parent shows the character).

He quotes other workers whose conclusions are not in agreement with his own:

Many cases of polydactylism are on record. The character appears to be regularly dominant, although in some instances it is imperfectly so. Thus, Lucas gives a family history in four generations in which there was one case of failure to dominate. Bellowitz gives several family histories in which polydactylism appears to be dominant. Milles considers the character as dominant. In poultry, polydactyle appears to be dominant.

In order to obtain first-hand information with reference to skeletal disturbances, we must turn to the writings of embryologists. Bagg and Stockard have done experimental work which may well be accepted as conclusive.

Bagg (2) states:

The origin of congenital defects of the limbs is a much confused subject. An inherited tendency to limb abnormalities has been noted in certain families, but no satisfactory explanation for their origin has been offered.

Abnormalities of the limbs are definitely inherited. They are recessive to the normal inheritance. When considered as one of the manifestations of a general tendency to abnormal structure, they approach the mendelian expectation in behavior.

The occurrence of congenital amputation or the entire loss of the distal portion of a limb at birth is, in the mind of the writer, but an exaggerated or more severe form of the same arrested embryonic development that produced clubbing, syndactylism, and hypodactylism in these animals.

Discussing the theories which have been advanced by clinicians, Bagg says:

Congenital clubbing of the limbs in man has been attributed to accidental mechanical disturbances that produce unusual and prolonged pressure upon the fetus while developing in the uterus; to the absence of amniotic fluid, in consequence of which the uterus was thought to press directly upon the feet of the fetus and become an efficient cause for their turning; to an arrest in the rotation of the limbs before birth, in which case the feet retain their fetal position with the little toes facing one another, and, finally, clubbing of the limbs was thought to result mainly from disturbance in the central nervous system of the developing embryo.

The writer believes that pressure upon the fetus *in utero* is unlikely to produce clubbing of the limbs, especially as the defect has been noted in uterine life as early as the third month of gestation and is frequently met with in fetuses between the fourth and fifth months. Deficient amniotic fluid can hardly be a potent factor in the production of clubbing, as in many well observed cases of this kind, perfectly formed infants have been born, and *vice versa.* If the theory of retarded rotation of the limbs before birth in relation to the production of club-feet was at all tenable, then we would have to account for the absence of bent knee, bent thigh, bent arms, etc., in

the fetus at birth as a result of muscular contraction in parts which are retained in approximation during uterine life.

Paralysis, due to a disease of the spinal cord, is a factor in the production of noncongenital club-foot in man, but such a cause can hardly be operative in congenital cases, because the leg in congenital talipes does not at all resemble the leg in infantile paralysis, and, if the deformity were due to a lesion in the central nervous system and paralysis resulting therefrom, not a single group of muscles, but a whole side of the body would be paralyzed, which is not the case in children with congenital club-feet.

The review given above leaves the question of the etiology of congenital club-feet and other congenital defects of the limbs entirely unsettled, and nowhere do I note reference to arrested embryonic development associated with a specific localized lesion in the clinical data upon which to base a tenable theory.

I shall briefly summarize the experimental results of the present communication before giving an explanation for the causation of foot defects as seen in my animals.

Over 5,200 individuals have been examined from my strain of inbred animals. They are descendants of the nineteenth generation of certain X-radiated mice. In this group, there has appeared a marked tendency to abnormal development. This tendency is inherited in approximately a mendelian fashion and is definitely recessive to the normal.

These observations indicate that clubbing and other defects of the limbs usually occur early in embryonic development and are first associated with localized arrests in development.

The results show still further that there is apparently an association between the degrees of severity of the pathological embryonic disturbance and, subsequently, the resultant type of foot abnormality. Congenital amputation in man has been ascribed to constriction of a fetal limb by either the umbilical cord or amniotic bands, but such an explanation does not fit the observed facts in my strain of animals.

Turning from Bagg to Stockard (36), we find that as early as 1920 he arrived at the following conclusions:

> The ordinary progress of embryonic development gives rise to individuals of rather uniform structure, yet there may be numerous slight variations and defects in the structural composition of various organs and parts. When the same deviations become exaggerated they may be ranked as serious deformities or anomalies. This fact renders the analysis of normal developmental processes and the experimental study of monstrous development one and the same problem.
>
> For the past two years I have claimed that all types of monsters not of hereditary origin are to be interpreted simply as developmental arrests. Such a position has been taken by others (Dareste, 1891). However, I propose, at this time, to present evidence which clearly demonstrates the truth of the claim.
>
> First, all types of monster, double as well as single, may be caused by one and the same experimental treatment; second, any one type of monster, such as cyclopia, may be produced by a great number of different experimental treatments; third, all effective treatments tend, primarily, to lower the rate of development, and fourth, the type of monster induced depends upon the particular developmental moment during which the developmental rate was reduced. Slowing the rate at one moment will produce a double monster or identical twins and at another moment, by the same method, will give rise to the cyclopean defect. In fact, the same thing which causes the double monster may later in development induce one of its heads to be cyclopean.
>
> Thus, there is no longer any ground for considering certain defects as specific responses to particular treatments. And there is as little reason for further description of individual monsters, since all belong to the same class and the individual differences simply result from the different moments during which the developmental interruptions have acted.
>
> In view of experimental results, it becomes

evident that normal development of the vertebrate embryo depends acutely upon the stability of certain factors in the environment. Changes in the condition of moisture, temperature, and oxygen supply are the most frequent causes of embryonic death as well as monstrous development. The highly complex forms, such as birds and mammals, with a long embryonic period, have partially succeeded in controlling their developmental environment. But in no case is the regulation constantly perfect and this fact is the underlying cause of frequent malformations and monstrous productions.

Comparison of the above statements with the work of Struthers shows that these embryologists are in agreement.

In view of the biologic data which I have quoted, I feel that we should accept the evidence and discard the fanciful theories. Bagg has shown, definitely, that the amniotic adhesion theory of origin is not tenable. I mention this theory in particular because it seems to have arrested the attention of, and has been accepted by, Cotton and Chute, Tubby, Taylor, Windle, and other clinicians.

Summarizing the evidence, I think that we are justified in concluding:

1. Deformities and defects are hereditary.
2. They are due to arrests of development at a particular moment.
3. There is no good reason to attempt to classify hereditary defects, as they can be legion.
4. Considering the classic work of Potel, Bagg, Stockard, and Jansen, there is reason to consider that exostoses and other dissociation phenomena which appear after birth are the result of biologic arrests. This will be discussed more fully later.

CLINICAL REPORT

In this series there are three syndactyl cases, all of which are associated with additional evidence of disturbance of development, thus bearing out the statement of Professor Thomsen, "Syndactylism unassociated with polydactylism is evidence of less radical disturbance of normal development."

Case 1. Baby G. D., aged 8 months. There is no familial history of congenital malformations.

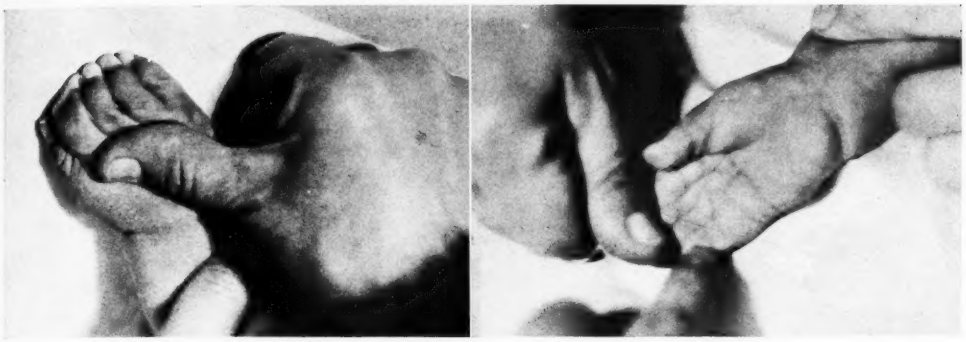
The patient was referred by Maud Loeber, M.D., with a diagnosis of syndactylism of the right hand (Figs. 1, 2, 3).

Physical Examination.—The right hand showed five well developed fingers and thumb. There was a definite web which united all of the fingers and the thumb. All of the fingers, except the index finger, were well developed and their outlines were definitely made out. The index finger was broader than the thumb and the nail of the index finger showed a definite bifurcation. The breadth of the nail was 1.5 cm.; the nails of the middle and ring fingers were a little over 0.75 centimeter. All fingers were flexed. The web between the thumb and index finger was very narrow. I could make out five first phalanges, but it seemed that the index finger had accessory second and third phalanges.

The X-ray films did not reveal any evidence of extra digits or an accessory phalanx as was indicated by clinical examination.

Three operations were deliberately planned and done before all of the fingers had been separated.

Comments.—There was no history that the defect was a familial characteristic. There was one perfectly normal child in the family, born prior to this deformed child. The only defect which the patient exhibited was complete syndactylism of the right hand. The terminal phalanx of the index finger was twice as broad as its fellow on the opposite hand. The nail looked like a double nail, suggesting that there were accessory second and third phalanges on the index finger. Although the X-ray films did



Figs. 1 and 2. Case 1. Complete syndactylism of the right hand.

not bear out this, at operation we did find an additional terminal phalanx.

The surgical problem involved in this case naturally consisted in trying to separate all of the fingers and to obtain a useful hand. On account of the age of the baby, it was decided to do several operations rather than one long operation. The end-result justified the means. The operative procedure followed was the Agnew operation, which I prefer because it provides for the formation of a web between each of the fingers.

Case 2. C. S., aged 4 years. The diagnosis was syndactylism, the thumb presenting three phalanges (Figs. 4, 5).

Physical Examination.—Examination on June 4, 1930, showed that separation of the "webbing" had been attempted in a previous operation, but the fingers had grown back together again. The Diddo type of operation seemed to have been adopted.

On the left hand there were four fingers and a digit, which was shorter than the index finger and was webbed with the index finger at the junction of the middle and terminal phalanges. There was complete webbing of the digits which corresponded to the thumb and index finger. A scar of a previous operation, probably of the Diddo type, was present. There was slight flexion of the first digit.

Palpation of what I took to be the first metacarpal revealed a long, thin bone much smaller than the other metacarpals. There were three phalanges.

On the radial side of the index finger of the right hand there was a small nail and what probably was an accessory digit on the radial side of the index finger, giving the index finger a broad, but step-like, appearance. The terminal phalanx with the nail was slightly flexed.

Palpation just below the styloid of the radius revealed a small, apparently rudimentary, first metacarpal which had a sharp point, very much like a cypress knee. Below that I felt a metacarpal which was continuous with the index finger. On the outer side of the first phalanx of the index finger, there was a small, apparently rudimentary, first phalanx which was movable and seemed to have no fixed point above. I could make out two phalanges, definitely.

My impression was that we had an accessory index finger on the left hand, and an absence of a thumb; the reason I believed this was because there were three phalanges.

It will be seen that my first impression of this case was that the first digit was an extra index finger and not a thumb.

It has been shown, in the section of the paper in which the literature is reviewed,

and also from the review of my own observations on normal bones and joints, that the position of the epiphysis of the first metacarpal corresponds with the epiphysis of the first phalanx of the other digits and not with the position of the epiphyses for the other metacarpals, thus suggesting the possibility that the first "metacarpal" is, in reality, a phalanx and not a metacarpal, and that in the evolution of the hand and foot there has been a loss of the first metacarpal for the first digit or thumb. This is an interesting problem in comparative anatomy and biologic evolution which may well form an independent thesis.

Case 3. The members of the family which we are about to discuss showed polydactylism as a dominant hereditary character. The mother had six well formed toes, without evidence of syndactylism. The X-ray films showed five well formed metatarsals and an incompletely developed sixth. The first phalanges of the two great toes on each foot articulated with the first metatarsal. No phalanx articulated with the incompletely developed metatarsal.

This patient had six digits on each hand; the extra digit which was on the ulnar side of the little finger was shorter than the other fingers. Roentgenologically, this digit was seen to have two phalanges and an incompletely developed first phalanx (Figs. 6, 7, 8).

The daughter had seven digits on one foot and six on the other, apparently two well formed great toes on each foot, and each great toe articulated with its own metatarsal. In this respect the patient differed decidedly from the mother. On the left foot there were two well formed little toes, each articulating with a single metatarsal which was incompletely bifurcated in its distal 0.5 inch, giving the appearance of a fork, thus forming separate articular surfaces for each first phalanx. On the right foot, each of the six toes articulated with its own metatarsal.

Fig. 3. Case 1. X-ray film made two and one-half years after original operation for complete syndactylism.

The hands were identical. Each presented six digits with only five metacarpals. The sixth digit had no metacarpal of its own, but rested against the ulnar side of the fifth metacarpal (Figs. 9, 10, 11).

As surgeons, we are confronted with the problem of removal of the supernumerary toe or toes when the foot is too broad to be accommodated by the average shoe. In the case of the supernumerary digit on the fibula side of the little toe, there is little cause for discussion or doubt as to the proper procedure, but when it is a supernumerary great toe, the question is one that requires study not only of the X-ray film, but also of the musculature of the respective toes. If the extensors and flexors are duplicated then it

does not matter, but if they are not, then one may, by chance, remove the wrong digit. This problem is more serious in the case of the hand if there are two thumbs, since the function of opposing the first digit, which we call a thumb, to the other digits is entirely dependent on its particular musculature.

In view of the above facts this group of cases becomes of more than academic interest to the surgeon.

Case 4. J. H., aged 20 years. The diagnosis was syndactylism, hypodactylism, ectromelia, and deficiency of the fibula (Figs. 12, 13, 14).

Physical Examination.—On Aug. 5, 1930, examination showed the right hand to be very narrow. There was no evidence of a thumb. There were only two fingers, evidently a middle and ring finger, and there was complete syndactylism of these two. Apparently there were only two phalanges to both fingers. There were only two metacarpals palpable.

The patient was unable to make a fist completely. He was unable to grasp an object tightly, but, as the result of necessity, after flexing the interphalangeal joint he pulled backward on the forearm in order to hold the object.

The left hand had a well formed thumb and two fingers which were completely united, and on the ulnar side of one of the fingers there was an angular deformity. On palpation this exhibited a blunt end and seemed to give the impression of springing from the first phalanx. The unusual feature about it was the great length of the first phalanx of what seemed to be the index finger. While the index finger had three well formed phalanges, the other finger seemed to have only two; in other words, there seemed to be only one interphalangeal joint which I could make out. The first phalanx of the finger on the ulnar side was bifurcated near the distal end and had two articular surfaces. There were apparently two terminal phalanges.

Fig. 4. Case 2. Syndactylism in a four-year-old child. The thumb has three phalanges.

The length of the index finger was 10 cm. from the metacarpophalangeal joint to the tip; the length of the other was 8.5 centimeters. The length of the first phalanx of the index finger was 5 centimeters. The length of the right hand from the metacarpophalangeal joint to the tip of the finger was 6.5 cm., the other, not over 6 centimeters.

There was a marked deformity of the right lower extremity. The tibia was saber-

shaped and the foot was displaced laterally and backward so that the tibia was prominent on the inner side. There were only three toes and a great toe. There was no evidence roentgenologically of the midportion of the shaft of the fibula. There was a small segment of the fibula corresponding to the upper epiphysis fused with the metaphysis, and a segment which corresponded to the lower epiphysis fused with the lower metaphysis. The shaft was absent for the most part.

Fig. 5. Case 2. The thumb with three phalanges.

Fig. 6. Case 3. Polydactylism in the mother of a family which showed the anomaly as a dominant hereditary character.

There was no deformity of the left leg, except that there were present only three

toes and a great toe. There was nothing suggestive of syndactylism.

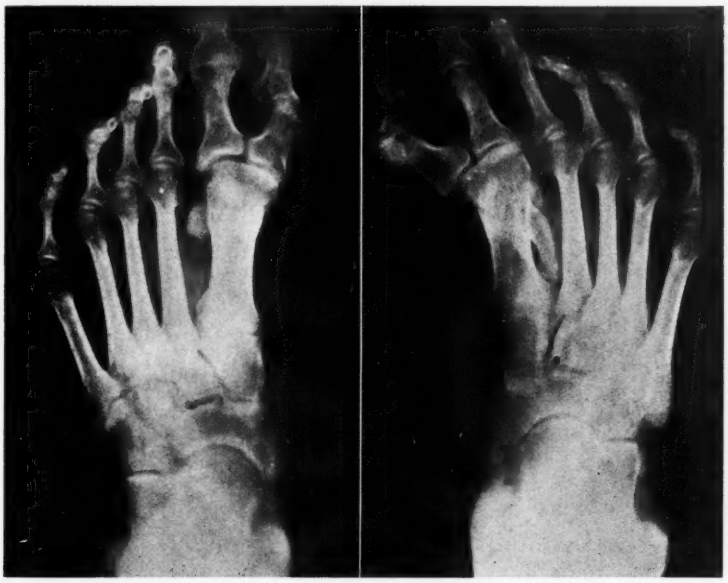
Unfortunately this patient disappeared after the examination was completed and it has been impossible to locate him.

Summarizing the clinical findings in this case there are certain conclusions which seem justifiable:

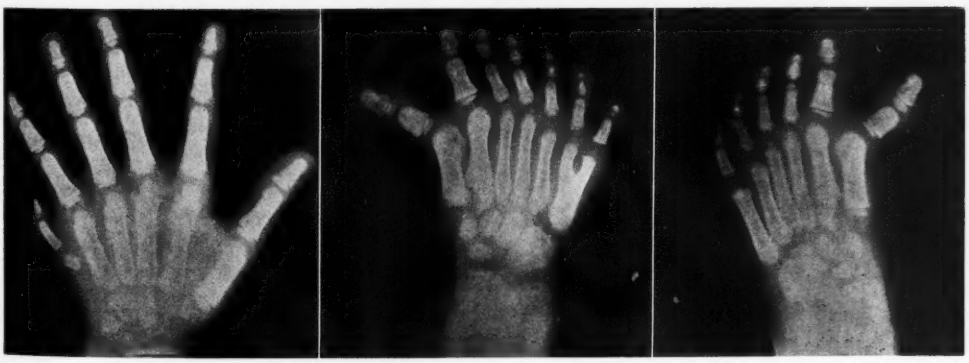
1. There is a definite hypodactylism, more marked on the right than on the left.

2. There are only two fingers on the right hand and three on the left, with evidence of an arrested development which causes a bifid appearance of the terminal portion of one of the phalanges.

3. On the right hand there are only two carpal bones to be seen roentgenologically; thus we may say there is an absence of six carpal bones on the right, and on the left hand there seems to be a fusion of some of



Figs. 7 and 8. Case 3. Films of the right and left feet, showing incompletely developed sixth metatarsal on each foot.



Figs. 9, 10, and 11. Case 3. Feet and hand of daughter in family with hereditary polydactylism. The hands were identical, each presenting six digits with only five metacarpals.

the carpals so that I can make out only three distinctly.

4. There is an absence of the major portion of the shaft of the fibula. The upper and lower epiphyses appear, with a small portion of the upper and lower portions of the diaphyses attached to them.

5. There is a fusion of some of the tarsal bones on the right and a hypodactyl and syndactyl condition present in both feet.

This case seems to bear testimony to the truth of the observations of Bagg and Stockard, that along with hereditary factors there must have been a developmental arrest responsible for the findings. The great variety of defects cited in this case could not well be accounted for in any other way.

Case 5. W. P., age 9 years. The diagnosis was ectromelia (Figs. 15, 16, 17, 18).

Physical Examination.—The entire upper extremity on the left was very much smaller and shorter than on the right. The only well formed digit on the left hand was the thumb. There was a small bud which looked like an abortive attempt at a little finger. There was limitation of supination and limitation of flexion of the elbow.

Fig. 12. Case 4. The patient exhibited syndactylism, hypodactylism, deficiency of fibula, and ectromelia.

X-ray films were made of both shoulders, both elbows, and both hands.

This case is one of the most interesting of all the skeletal defects and disturbances that I have seen. We see that one of the upper extremities presents, at the shoulder and elbow, the appearance of at least one year's difference in skeletal growth. At the wrists there is even a greater divergence in the skeletal ages, the right wrist being that of a child of nine years, while the left appears that of a child between five and six years of age. Only one digit on the left hand has well formed phalanges. There are two distinct well-formed metacarpals and three that are rudimentary. The entire upper extremity on the left is shorter than on the right.

This case, I believe, can be explained only as a developmental arrest.

It would be futile to try to present cases from the literature as this would serve no useful purpose, not even for classification. Any attempt at classification except in a general way would be ridiculous. There are millions of possible combinations of defects and we might as well satisfy ourselves with the conclusions of Stockard: "There is little reason for further description of individual monsters as all belong to the same class and the individual differences simply result from the different period during which the developmental interruptions have acted." Extensive articles have been written in all languages and these are referred to in the bibliography.

Fig. 13. Case 4. Defect in the fibula and absence of the shaft.

DYSCHONDROPLASIA

We come now to the phase of the subject which is most confusing and the conclusions at which I arrive are certainly in a controversial field. Even so, the suggestions which are here made may stimulate those well qualified to prove or disprove my statements.

I believe that the evidence which has been collected indicates that dyschondroplasia and other congenital deformities are identical in origin.

I have been especially impressed by the marvelous work of Jansen, and at the same time with the evident neglect of his important conclusions by many recent observers. Let me say at the outset that I believe with Jansen that dyschondroplasia is distinctly a dissociation phenomenon.

A careful study of his conception of the various factors involved in normal bone growth and the dissociation phenomena which give rise to exostoses cannot help but be profitable.

Before proceeding further it may be well to review the literature. "Dyschondroplasia," "dissociation phenomena," "multiple epiphyseal chondromas," "exostoses," and many other names have been used to describe a skeletal disturbance, reference to which is not uncommon in the literature.

According to G. G. Davis the condition was

described by Caesar Hawkins in 1837. The first case to be reported in the United States was by Virgil B. Gibney (19) on March 24, 1875, when he presented at the New York Pathological Society a boy of 13 years who

Many of the earlier writers attempted to prove the association between multiple exostoses and achondroplasia. Jansen reports that Bessel-Hagen, in 1891, found that, almost without exception, patients who had

Fig. 14. Case 4. Radiograms gave no evidence of the midportion of the shaft of the fibula.

had well marked exostoses on the upper end of each tibia and the proximal end of each humerus, and one on the left index finger.

Gibney again presented this patient before the same Society on April 23, 1897.

In 1876 he reported a Prussian family in which there were six members affected with the disease. These six patients represented three generations, one in the first generation, two in the second and three in the third generation.

multiple exostoses showed a stunting of growth.

Jansen also quotes Fischer, who described giant-growth in three members of a family who presented exostoses. Others, notably French authors, have described gigantism in cases of multiple exostoses. "Stunting of growth is not to be considered as a symptom associated with multiple exostoses."

In 1898, Ollier reported two cases of cartilaginous dystrophy in which the extremi-

ties of one side of the body were markedly retarded in growth, and to which he gave the name of dyschondroplasia. He defined dyschondroplasia as "an affection of the period of growth, with arrest of growing parts of the skeleton, with nodosities and swellings of the extremities of the corresponding long bones, curving of diaphyses, and slight but constant deformities of the hands." He considered one-sidedness characteristic of the disease.

Fig. 15. Case 5. Ectromelia in a nine-year-old patient. Great divergence in the skeletal ages is shown, the right wrist being that of a child of nine, and the left having the appearance of that of a child of from five to six years old.

In 1910, Molin, a pupil of Ollier, published a thesis at Lyons entitled "Dyschondroplasia." His conclusions were:

1. Dyschondroplasia is an osseous dystrophy characterized from a clinical point of view by partial arrest of development of the skeleton.

2. The disturbance of the bony growth affects by preference the long bones of the extremities and the metacarpophalangeal skeleton of the hand.

3. The long bones show curvatures analogous to those of rickets.

4. Joint deformities must be considered as the direct consequence of bony alterations.

5. Only the roentgenograph allows the nature of the dystrophy to be observed; it approaches that of rickets and chondroma but does not completely simulate them.

6. The definite isolation of this condition cannot be made on account of the absence of complete microscopic findings.

7. The identity of dyschondroplasia and

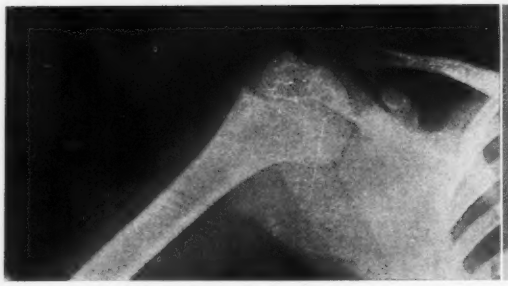


Fig. 16. Case 5. Right shoulder.

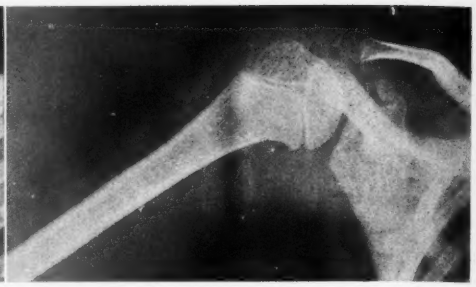


Fig. 17. Case 5. Left shoulder. Comparison of this view with Fig. 16 shows the difference in skeletal growth when compared with the right shoulder.

osteogenic exostoses needs further pathologico-anatomic control.

8. The etiology is absolutely unknown. (*Quoted from Cole.*)

It should be noted that Molin and Ollier suggested a partial arrest of the development of the skeleton and that the identity of dyschondroplasia and exostoses needed further investigation. When one considers that this was thirty-one years ago, it is rather interesting to note that such an early lead was not followed up. While it is true that others in America have discussed the disease and reported individual cases, the excellent review of the literature by Ehrenfried, in 1915, has been most extensively quoted by subsequent writers. He was able to collect over three hundred articles, representing about 600 cases, the majority of which had been reported by German, French, and English writers. Up to that time Ehrenfried was able to find only 12 cases which had been reported in America.

Fig. 18. Case 5. The difference in skeletal growth is shown by X-ray films of the elbows.

Ehrenfried (15) stated, "A great deal has been written about the pathology and much confusion exists at the present time [1915]." This confusion he believes to be due to the fact that "most of the theories date to pre-roentgen days, and that the attention of the pathologists has been directed toward the relatively unimportant exostosis, rather than to the intermediary cartilage at the epiphyseal line." He believes that the theory of the inheritance of a faulty anlage for the bone-producing intermediary cartilage is still accepted. He states, "The disease consists, in brief, of a disturbance in the process of proliferation and ossification at the intermediary cartilage during the period of skeletal growth."

Comment.—Note that Ehrenfried considered that the disturbance occurred during the period of growth. My thesis is that the arrest occurs prior to birth and manifests itself during the growth period.

When discussing the characteristics of the disease Ehrenfried states:

The skeletal disturbance and malformations are generally symmetrical for the two sides of the body. The affection is distinctly one of the period of skeletal growth. Manifestations increase with skeletal growth and cease with

maturity. Generally the cases have shown irregular juxta-epiphyseal hyperostoses, particularly marked at the knee, hip, shoulder, ankle, and wrist. The lower end of the femur and the upper end of the tibia have shown a characteristic squaring off, with spurs at the corner, running upward from the femur and downward from the tibia.

H. W. Marshall (30) made no attempt to discuss the theories of origin for, he says, "None can be proved beyond question. No observations have been made that are antagonistic to Ehrenfried."

Ashhurst states, "The underlying pathologic change in cases of this sort is a chondrodysplasia affecting the metaphyses of the long bones, with the exostoses being merely incidental and not the essence of the disease." (*Quoted by Cole.*)

After reporting a personally observed case and reviewing the literature Cole concludes:

1. 'Ollier's disease' is a term which seems fixed in the literature but which should be used to designate only those cases of cartilaginous dystrophy with or without cartilaginous tumor or exostosis formation, which show an asymmetrical involvement of the body as the outstanding clinical feature.
2. 'Chondrodysplasia' (a term preferable to 'dyschondroplasia') is a condition which is usually asymmetrical but as several symmetrical cases are on record the term must, therefore, be broader in its application than 'Ollier's disease.'

The gradation of reported cases between those of frank multiple cartilaginous exostoses, on the one hand, and the so-called chondrodysplasia with no change in anything but the internal architecture of the bones (Voorhoeve cases), on the other, is so varied and irregular that a definite classification of cartilaginous dystrophy is still impossible. The possibility that the apparently widely different findings in some of these cases are only manifestations of different stages of the same condition must not be overlooked.

It should be remarked that Cole would

Fig. 19. Case 6. Dyschondroplasia accompanied by marked bowing of the forearm, which was more noticeable on the dorsum of the forearm when it was pronated. (Film made in 1921.)

Fig. 20. The same case, from an X-ray film made in 1926.

restrict the use of the name "Ollier's" to an asymmetrical skeletal retardation. It is interesting to note particularly Cole's final conclusions in which he speculated about that which seems to have been conclusively proved by Jansen's more recent work.

Sir Arthur Keith (26) stated:

Multiple exostoses is usually placed by surgeons in the category of tumors, but a close examination of anatomic changes shows that it should be definitely placed among the disorders of growth and given a name to indicate its true nature. The name I propose, one suggested to me by Mr. Morley Roberts, is 'diaphyseal aclasis,' because the main incidence of the disturbance falls upon the modelling or pruning of the diaphyses or shafts of bones.

Characteristically, Sir Arthur Keith was able to find in his industrious researches that John Hunter had laid the foundation for what seems to be to-day the most logical conception of this condition.

Quoting Sir Arthur Keith:

One of John Hunter's more important discoveries was his realization that the shafts of new bone grew in length by a double process; there was first the deposition of new bone in the cartilaginous growth disc at the ends of the shaft, a process clearly recognized before Hunter's time; there was in the second place 'a modelling process' by which the new bone thus laid down was pruned, reformed, and incorporated as an intrinsic architectural part of the cylindrical shaft. Hunter clearly recognized that these two processes were independent operations. If Hunter's teaching is true, then we ought to find disorders of growth in which deposition of new bone goes on while the second, or remodelling, process is retarded or even completely arrested. A survey of the skiagraphs of the first case of multiple exostoses that came my way showed me that in this disorder the deposition process goes on, but the modelling process is retarded and aberrant. In multiple exostoses, which is a disorder of youth and of adolescence, then, the modelling process is profoundly retarded; in some instances almost arrested. The bony excrescences, or tumors, which serve as diagnostic marks for the clinical recognition of the condition, are merely secondary results of the primary disorder of growth for which I propose the name of 'diaphyseal aclasis.'

Bentzen, in 1924, concluded:

Ollier's disease represents the typical reaction of the bones against certain disorders in the innervation of their blood vessels. It is often confined to one-half the body. Masses of hyaline cartilage are found to follow paths similar to those of the arteries of the bones. The pathologic processes in the bone tissue may be assumed to be related to the formation of callus in a fracture in which the blood vessels have been interrupted. *(Quoted from Cleveland, 7.)*

Cleveland stated:

Bentzen disagrees with Ollier and Wittek, who described the disease as a disturbance of epiphyseal growth. He regards this as a secondary phenomenon. The primary focus is, he believes, in the diaphyses, which are nourished by a single large nutrient artery. From an experimental standpoint, working with rabbits, he was able, by interrupting the sympathetic nerves, in some instances to produce structural changes in bone similar to those seen in Ollier's disease. Bentzen's theories of the etiology of Ollier's disease, supported by his studies, form a valuable contribution.

In 1910 Gossage and Carling (22) emphasized the hereditary nature of the condition. The confusion which existed at that time with regard to the condition is illustrated by the following statement quoted from Gossage and Carling: "There is undoubtedly some relationship between cartilaginous exostoses and multiple enchondromas and of both with the peculiar disturbance of growth described by Ollier and known as 'dyschondroplasia.' "

From the above it can be seen that those authors looked upon the condition as three separate entities, but with some relationship.

In 1913, Thomas R. Boggs (4) discussing multiple congenital osteochondromas, stated: "There is much reason to accept the view that these tumors are truly congenital and due to abnormal anlage in the intermediary cartilage (*von Bergmann*)."

In 1915, R. D. Carman and A. O. Fisher (6) also accepted the theory expressed by von Bergmann. Quoting from their work we find: "The general involvement of the epiphyses, with the relative freedom from involvement of the shafts, is very striking and seems to support the most plausible theory advanced by von Bergmann and others with reference to the etiology of this condition, namely, that the lesions arise in abnormal anlage in the intermediary cartilage."

Again in 1925 Horace E. Campbell (5) expressed the belief that "the most probable explanation is that there is a disturbance in development of the intermediate cartilage due to an original defective anlage." He further states that there is "little known concerning the etiology."

In 1930, Olan R. Hyndman (23) stated:

Like practically all of the hereditary disease entities of the skeleton, the etiology of chondrodysplasia remains a mystery.

Although the primary factor is not established, it would seem to me that at least one fact is tenable and clear, that cartilage rests are left in the wake of a chaotic advancing epiphysis, and these rests undoubtedly form the nucleus of the anomalous benign tumors.

Up to this time very little attention had been paid to the work of Murk Jansen and of Sir Arthur Keith, and, with the exception of Keith's brief mentioned statements of John Hunter, little or no attention was paid to the undeveloped ideas of dissociation of bone growth to which John Hunter gave a definite clue. Great credit is due Jansen, and his views should be more generally accepted. I believe many of the conditions which to-day are considered separate entities will probably eventually be included under retardation phenomena after the significance of Jansen's work is more generally appreciated. It is difficult to abstract this study briefly and for that reason I will quote rather extensively from the original surgical essay which appeared in the Jones Birthday Volume.

Jansen states:

Six different processes, and probably more, have to co-operate harmoniously in order that the bones shall attain their proper size, shape, structure, and composition when completing their growth. These processes are resorption, tubulation (*i.e.*, the transformation of metaphysis into diaphysis), cancellation (*i.e.*, the formation of cancellous tissue), cell division, cell enlargement, and differentiation. Sometimes one or more of these processes will be delayed with regard to the other processes during a shorter or longer period, *i.e.*, dissociates itself from those processes. And the dissociation of each of these processes evokes its own characteristic symptoms which for the present may be concisely stated in the tabulation on the following page.

The cause of dissociation of growth probably lies in disturbance of the sympathetic nervous system, through which either a defect or an excess of elements for bone growth is furnished.

The clinical picture, according to Jansen, is characterized by its extreme polymorphism. In some cases only a single bone is found to be affected and in others the condition presents itself on both sides. I mention this statement because in one of our cases the retardation phenomena are limited to a single bone, the radius on one side, and in the other cases there is evidence of retardation phenomena in almost all of the bones of the skeleton, except the skull and vertebræ.

Dissociation (through retardation)	Causes
Of resorption, *e.g.*, of the tuberosity of the ribs, of the trochanters, the obturator borders of the ischial and pubic bones, or also in the meatus auditorius externus.	Exostoses Too wide ischial and pubic bones (a two small obturator foramen)
Of tubulation	
(a) Over the whole circumference of	*(a)* Lengthened metaphyses
(b) Over part of the circumference	*(b)* Exostoses
Of cancellation	Striated and mottled metaphyses
Of cell division	
(a) Over the whole area of the growth cartilage	*(a)* Thin, eventually invisible, discs and shortened bones
(b) Over part of the area of the growth cartilage	*(b)* Obliquely situated or cone- or cupola-shaped, irregular growth discs with varus-valgus flexion or hyperextension positions of the long bones.
Of cell enlargement (?)	
Of cell differentiation	Chondroma, enchondromas, giant-cell tumors, *i.e.*, dissociation tumors.

Jansen emphasizes that any symptom may predominate in the clinical picture and: "The symptoms may be associated with the other symptoms in every conceivable combination and in every imaginable locality, though only in the bones formed in cartilage."

PATHOGENESIS

Discussing pathogenesis Jansen says:

It should be remembered that during the growth of bone, resorption of the metaphyses has to keep pace with longitudinal growth.

During growth the epiphysis is displaced distally by the growth disc, the metaphysis is not. The processes of resorption of the cancellous tissue and its transformation into the compact diaphyseal tube we will call 'tubulation of the metaphysis' or, shortly, 'tubulation.' It stands to reason that only if the tubulation keeps pace with the longitudinal growth of the bone will the normal funnel shape of the diaphysis end lie close to the epiphysis; whereas an approximately cylindrical area of cancellous tissue produced by the growth disc must be expected to lie between the funnel-shaped end of the metaphysis and the growth cartilage, when tubulation is retarded. Hence, the conclusion presents itself that the cylindrical or barrel-shaped area between the growth cartilage and the funnel-shaped metaphysis, which we will call 'lengthened metaphysis,' is caused by a retardation or tubulation, *i.e.*, by a dissociation of tubulation from the processes of longitudinal growth through either relative or absolute retardation.

What causes the local impediment to tubulation is as yet unknown.

Taking everything into consideration, we cannot help believing that the lengthened metaphysis is the result of a retardation of tubulation over the whole periphery of the bone, *i.e.*, a total retardation of tubulation, and the exostoses a partial retardation of tubulation, *i.e.*, these two phenomena appear to us as the result of a total and a partial dissociation through retardation of tubulation with regard to the other processes of longitudinal growth.

Virchow, Ollier, and all other authors, as well as ourselves, consider enchondromas to be caused by the failure of one of the growth processes, *viz.*, by what in the above has been termed 'dissociation of one of the growth processes through retardation with regard to the others.'

According to Virchow, exostoses are caused by a stimulation of the growth cartilage which evokes undue lateral growth.

There is no denying that the picture of the development of exostoses sketched by Virchow is anything but clear. 'Stimulation [by what?] of the growth cartilage' causes 'undue [why?] lateral [why and how?] growth.' If this were correct, this cartilage would have to start its growth from the side opposite to that from which it grows normally.

We are tempted to assume that each of the processes of bone growth may be retarded with regard to the others, either over the

whole area of its activity in a bone (total dissociation) or in part of it (partial dissociation), each dissociation leading to characteristic phenomena:

Total retardation of cell division in a growth disc causes thinning of the growth disc, shortening of the bone, and trumpeting of the metaphysis;

Partial retardation of cell division causes deformations of obliquity of the growth disc and deformities in the bone;

Total retardation of differentiation causes cartilaginous metaphysis;

Partial retardation of differentiation causes clear areas in the bones. Both total and partial retardation may form tumors (dissociation tumors);

Retardation of cancellation causes gross longitudinal striation—and, possibly, also dense stippling (?);

Total retardation of tubulation leads to lengthened metaphysis;

Partial retardation of tubulation leads to the development of exostoses; whilst

Retardation of resorption leads to the development of widened bones, enlarged apophyses, and probably also of button-shaped exostoses on the ribs.

Geschickter (18), in a recent contribution, discusses dyschondroplasia, saying:

The fundamental basis of the congenital disturbance is obscure, but deficiencies in the periosteum and a tendency for the perichondrium to persist and to function as such, together with precartilaginous connective tissue about the joints, seem to be responsible for most of the deformities . . . The process is extremely complicated but it shows what a fine state of balance among various tissues of similar function is necessary to produce the normal.

One will note from the above quotation that Geschickter comes very close in his conclusions to those of Jansen, but apparently he feels still uncertain about the underlying cause. However, his realization that there is a fine balance among various tissues and similar functions necessary to produce normal shows a definite leaning toward Jansen's conclusions.

Fig. 21. The same case as shown in Figures 19 and 20, from a film made in 1927.

Wahren's (44) clinical experience appears to support and illustrate clearly the theory of Murk Jansen. Wahren states:

The exostoses and the elongation of the metaphyses are co-ordinated symptoms which develop through an inhibition of that process, which effects during growth a metamorphosis of the metaphysis into diaphysis. This process is termed 'tubulation' by Murk Jansen.

This brief summary of the literature justifies, I believe, certain conclusions:

1. Dyschondroplasia and other congenital deformities are identical in origin.

2. Dyschondroplasia is evidence of retardation or dissociation phenomena in bone growth. Such phenomena may be partial or complete. Partial retardation of tubulation leads to exostoses. Total retardation of tubulation leads to long, wide metaphyses.

3. Dyschondroplasia may be limited to a single bone or it may involve almost all of the bones of the skeleton. We have seen involvement of all long bones, and the scapulæ, ribs, and pelvic bones as well. It may manifest itself in shortening, bending, or widening of the metaphyses and exostoses.

4. The theory advanced by Jansen explains all of the phenomena which are found.

5. The clinical experience which we have had adds to the weight of evidence in favor of Jansen's theory.

CLINICAL REPORT

The following summaries of cases which we have observed are here presented.

DYSCHONDROPLASIA

The first case to be presented is of particular interest because the manifestations of the "disturbance" are limited to one bone.

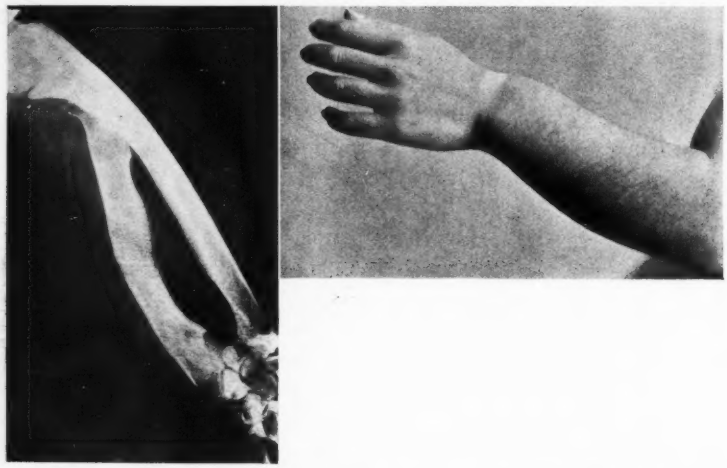


Fig. 22 *(left)*. The same case, from a film made in 1931. There has been complete union between the epiphysis and the diaphysis at the lower end of the radius.
Fig. 23 *(right)*. Case 6. The photograph was made five years after the original observation. The disturbance was limited to a single bone.

This case is of interest when we compare it with the description of the cases which are to follow. In our other cases we have an almost universal evidence of retardation of tubulation or dissociation phenomena. In this case we have the dissociation phenomena limited to a single bone. In the succeeding cases, dissociation phenomena were both complete and partial, evidenced by the formation of exostoses, as well as long metaphyses. In this case there were no exostoses, but just a retardation of tubulation.

It is comparatively easy at this time to classify this case, but as will be seen from my original notes, rickets, osteitis fibrosa, and endocrine disturbances were considered, only to be finally abandoned. While it may seem rather far-fetched, I believe it, nevertheless, worth while mentioning as a precaution that the absence of a febrile reaction

and other evidences of infection should certainly make one avoid the error of suggesting osteomyelitis as a diagnosis. Giant-cell tumor might possibly have been offered as a diagnosis and the patient operated upon unnecessarily.

The explanation offered by Jansen, I believe, clearly places this case in the category of dissociation phenomena.

Case 6. E. A., age 13 years, was first observed on Oct. 7, 1926. The diagnosis was dyschondroplasia (Figs. 19, 20, 21, 22, 23). There was no history of a definite injury. There was pain in the left wrist, particularly when carrying heavy objects. The child had never stopped her ordinary activities except that her left wrist tired when she was practising on the piano. The condition for which she consulted me had first been noticed about five years before the present examination, at which time she had been taken to another physician.

Physical Examination.—The patient is a well developed and well nourished female child, height 4 ft. 8 inches. There was nothing unusual to be noted about the contour of the face, the teeth were in excellent condition and no prognathism was noted. The contours of the shoulders were identical. There was no limitation of motion of either shoulder; no noticeable deformity of the scapulæ was found.

Examination of the elbow revealed that the carrying angle on the right side was normal. There was a diminished carrying angle on the left, with a deviation to the ulnar side. There was marked bowing of the forearm about two inches above the wrist, which was more noticeable on the dorsum of the forearm when it was pronated. There was a prominence in the antecubital fossa. There was some atrophy of the thenar and hypothenar eminences, and the muscles of the fingers. Palmar flexion was increased; dorsiflexion was limited.

The lower extremities were the same length by actual measurement. The great trochanters were apparently on the same level. There was no bowing of either thigh or leg, and no limitation of motion of the hip, knee, or ankle on either side.

The blood calcium was 10.5 mg. for 100 c.c. of blood, and the phosphorus content was 0.95 mg. for 100 c.c. of blood. The Wassermann test was negative.

The X-ray films showed a marked bowing of the left radius, the lower portion of the shaft being broader than its fellow. The lower epiphysis of the radius, instead of being transverse, was oblique and irregular. The radiologists (E. C. Samuel, M.D., and E. R. Bowie, M.D.) reported: "The condition is strongly suggestive of dyschondroplasia."

The appearance was so unusual that Dr. Samuel and Dr. Bowie suggested they would like to have the opinion of another radiologist. Accordingly they sent the films to a distinguished radiologist in a distant city who suggested that the condition was probably a Madelung's deformity.

I advised the mother that I did not believe this to be a Madelung's deformity, but I thought it to be associated with a nutritional disturbance, probably a late rickets or an osteitis fibrosa cystica. Further, I advised her that, if the disease progressed, it would be wise for her to consult either Dr. Joseph Bloodgood, of Baltimore, or Dr. Dallas Phemister, of Chicago.

Following up the idea which we originally expressed, the patient was given a diet rich in calcium and phosphorus, and general body irradiation. She showed no improvement, but there was no progress of the deformity and no other bone of the skeleton became involved. After a short time the treatment was discontinued as I did not believe that we were obtaining any benefit.

From time to time radiograms have been made, the last one in September, 1931. There has been a complete union between the epiphysis and the diaphysis at the lower end of the radius. If we are to take the

postulates of Molin as a basis for classification, the bowing and shortening of the radius, the obliquity of the epiphysis, the lack

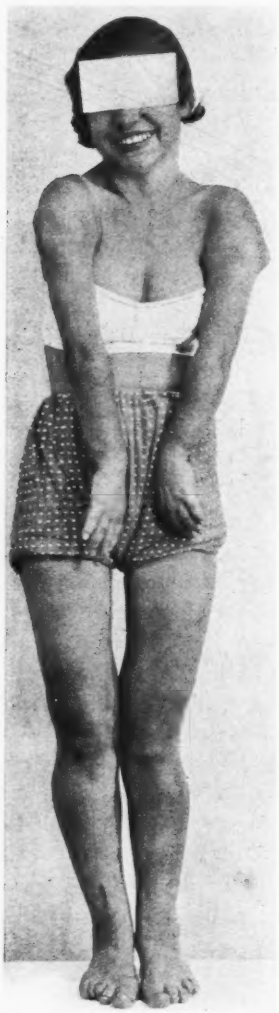


Fig. 24. Case 7. Dyschondroplasia. The nodules are widely distributed over the skeleton. Note the marked bowing of the right forearm and the shortening of the ulna.

of tubulation of the lower end of the metaphysis, and the vacuolization definitely place this case in the group of dyschondroplasia.

Case 7. J. C., age 18 years. The diagnosis was dyschondroplasia (Figs. 24, 25, 26, 27, 28, 29, 30). This report is as of October, 1931.

Clinical History.—The patient was first seen on May 18, 1921, at which time the following notes were made. From the time the child was three years old, the mother had noticed small nodules near all of the large joints. In every other respect the child seemed perfectly well.

On examination we found widely distributed over the skeleton many large, hard, circumscribed, nodular masses, which were neither adherent to the skin nor tender to the touch. The large nodules were located on the left leg, in the region of the external malleolus; on the right leg, just above the internal malleolus; over the right ulna, in the region of the styloid process; over the left radius and ulna, and a small spur-like mass in the region of the right shoulder.

On account of the great number of masses which were present I advised removal of only those which interfered with function.

Operation.—On Oct. 7, 1921, the first operation was performed, consisting of linear incision on the inner side of the left knee, the upper limit corresponding to the epiphyseal line of the tibia. Care was taken not to injure the insertion of "hamstrings." Periosteal incision was made and a periosteotome was inserted between the growth and the shaft. The mass was elevated easily and removed *in toto*.

Incision was made along the lower third of the radius midway between the flexor and extensor tendons. The radial nerve came into view very readily and was retracted. The extensor longus pollicis was retracted to the dorsum of the forearm. After retracting the flexor muscles, the periosteum was incised and a periosteotome was inserted between the growth and the radius, and the growth removed. We then found a second growth on the dorsum of the radius which

we removed. A small enchondroma on the index finger was removed.

On Aug. 4, 1922, a second operation was performed. An incision about two inches long was made about the external malleolus of the left leg. An enchondroma about one and one-half inches in length was easily removed; the only thing necessary was to lift it from the shaft of the fibula by means of a periosteotome.

A small incision was made over the dorsum of the right foot, corresponding to the third metatarsal, and a small enchondroma was removed.

The girl continued under observation and it was not until 1930 that she noticed an interference with walking because the masses about the lower end of the right tibia had increased markedly in size. At that time (August, 1930) a series of X-ray films was made.

These films showed that the metaphysis of the upper end of the right humerus extended from the level of the anatomic neck to the junction of the middle and upper third of the shaft. On the outer side of the region of the great tuberosity there was a large vacuolated mass which was of less density than the normal shaft. The upper third of the left humerus showed a marked vacuolization, with a large spur-like mass about two inches below the upper end of the metaphysis. The radiogram of the pelvis showed a large mass springing from the posterior iliac crest. This mass was much less dense than the remainder of the ilium. There was a bilateral coxa vara. Each femur had a short neck, and an increased transverse axis of the intertrochanteric line, giving the impression of an interference with tubulation.

The films of the knees show wide metaphyses, marked vacuolization, and a large spur-like mass springing from the inner aspect of both femora, about the level of the adductor tubercle. There was a wide metaphysis and marked vacuolization of the upper end of the fibula, with a small spur-like projection on the upper aspect of the metaphysis of both tibiæ.

There was marked widening and lack of

Fig. 25. Case 7. Posterior view, showing the multiple lesions.

tubulation of the lower metaphysis of the tibiæ, and sessile, spur-like formations. Similar evidences of deformity were noted in the metatarsals.

The right forearm showed a marked bowing of both radius and ulna with shortening of the ulna.

At the time that these films were made, the mass about the right ankle was beginning to interfere with function and the patient was advised to submit to operation.

Fig. 26. Case 7. Dyschondroplasia. The film shows marked bowing of both radius and ulna with shortening of the latter.

She was seen again in January, 1931, and at that time the following notes were made:

Growth is stunted; the patient is only five feet tall.

Both upper extremities seem to be short, especially the forearms.

On the outer side of the right arm there is a large mass which extends down for about three inches. This mass is hard and nodular, and the skin, which is freely movable over it, is not glossy.

On the left side of the median line, approximately at the level of the sixth dorsal vertebra, there is a mass about one inch in diameter which seems to spring from one of the ribs. Like other lesions, it is fixed, nodular, and has a bony hardness.

On the angle of the scapula, on the left side, there is a similar nodular mass. None of the masses is painful.

On the crest of the left ilium there is a mass about three inches by two inches. This lesion has all the characteristics mentioned before except that it is very much larger than the others.

On both sides of the left leg below the knee there are similar masses. There is a scar on the outer side of the left knee indicating the site of a previous operation. On the inner side of the left knee, there is a bony lesion.

The mass on the outer side of the right leg which extends into the popliteal space is one of the largest that she has.

In front of the right ankle there is a large lesion which is causing limitation of motion.

In June, 1931, the following operation was performed. Incision about three inches in length was made over the anterior inner aspect of the right leg, just above the ankle. The muscles were retracted and a hard, bony mass with multiple bosses on its surface was then seen. With a Campbell gouge and mallet, the bony growth was cut away from the tibia. Incision was made over the ulnar side of the right forearm and a mass similar to the one on the leg was removed in a like manner.

On Sept. 2, 1931, the patient returned for examination and the following notes were made:

The contour of the right leg is markedly improved; in fact, the anterior aspect of the lower third of the leg is perfectly straight. She is able to stand on her toes and at the present time there is no limitation of motion in either ankle.

The deformity about both shoulders, and the crest of the ilium is such that I have advised operative intervention in these regions.

Up to the present time I have removed seven of the masses because they were interfering with function.

Comments.—In making the diagnosis, multiple cartilaginous epiphyseal enchondromas, I was conforming with the commonly accepted term. It becomes immediately apparent, as one looks at the films of this patient's skeleton, particularly the humeri, femora, and tibiæ, that these outgrowths, which like spurs interfere with

joint function, represent but a small part of the disturbance in growth and development of the pathologic process. I use the expression "pathologic," not in the sense of disease but in the sense that there is a lack of harmony among the various processes which have to do with normal bone growth.

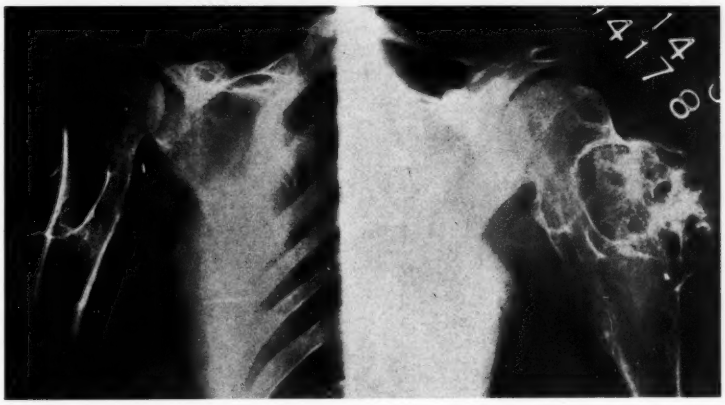


Fig. 27. Case 7. A large mass in the region of the right tuberosity and upper third of the left humerus.

The fact that these lesions are multiple shows their relationship to something which has to do with abnormal development.

These lesions are benign in the sense that they do not endanger life, but malignant in the sense that they are disabling and deforming. We take them off if they begin to interfere with function. We must not attempt to do too much during the early period of growth because of the danger of early bony union of the metaphysis and epiphysis which would interfere with growth in length of the skeleton. Except with the pedunculated masses, no attempt to interfere surgically is advisable.

All ideas of which I had knowledge, prior to the appearance of Murk Jansen's epoch-making study, did not seem to explain satisfactorily the wide metaphyses. His explanation clearly accounts for every phenomenon which one sees in such cases. It is true that John Hunter had paved the way and that Sir Arthur Keith had developed a theory based on disturbance of the endocrine system, but no detailed satisfactory explanation, so far as I know, had before appeared. Dissociation phenomena due to a complete retardation of the process of tubulation result in a wide metaphysis, and partial retardation of tubulation causes exostoses.

This last statement is verified by the last case of the series.

Case 8. Miss B., 20 years old. Diagnosis was dyschondroplasia. *History.*—Ten years earlier she had noticed a small, hard mass about 0.5 inch in diameter on the right scapula. A little later she noticed similar small bony masses on the inner aspect of the left thigh and the left leg just above the ankle. Four years later she noticed a growth on the left side of the chest under the breast. One year later a mass appeared on the inner aspect of the right leg just below the knee. During the five years previous to examination, the patient had noted similar masses develop on various bones of her body. The growth of all of the masses has been slow and painless.

She was prompted to consult a doctor because of the large size of the mass on the inner aspect of the left thigh just above the knee which had begun to interfere with function.

Fig. 28. Case 7. A large mass springing from the posterior iliac crest and bilateral coxa vara. There was evidence of retardation of tubulation of the femora.

Fig. 29. Case 7. Note the large masses springing from both femora, and the wide metaphysis at the upper end of the fibulæ, with spur-like masses on the inner aspect of both tibiæ.

Physical Examination. — Examination made on Nov. 3, 1931, revealed the patient to be fairly well developed, about five feet tall. There was nothing unusual about the face and certainly no loss of symmetry. The shoulders were apparently symmetrical and the contour was not altered. There was a fullness in the infraclavicular spaces on both sides. The breasts were symmetrical. There was nothing unusual in the appearance of the chest or abdomen. Looking at the back we noted an irregular nodular appearance about the spine of the right scapula.

The lower extremities were asymmetrical in that the left thigh was less well developed than the right. There was a large prominent conical mass on the inner aspect of the left thigh just above the knee. The skin covering this was not altered in color. There was a prominent mass on the inner aspect of the left ankle.

On palpation over the right scapula, in the region of the spine particularly, we found a nodular mass which seemed to spring from the region of the body of the spine of the scapula and the vertebral border.

There were nodular masses on the upper outer portions of both humeri. The coracoid process seemed unduly large and nodular. The left forearm was shorter than the right. There was a nodular, prominent, hard mass on the dorsal and volar aspects of the radius at the lower end.

Under the outer upper quadrant of the left breast there was a hard, nodular mass which seemed to spring from about the third or fourth or the fourth or fifth rib.

Below the anterior crest of the ilium on both sides there was a hard, nodular mass which was not adherent to the skin and which was not tender. On the inner aspect of the right femur, about the level of the abductor tubercle, there was a hard, sessile mass from approximately 2.5 inches to 3 inches in the transverse axis and 2 inches in the long axis of the body. This sessile growth seemed to spring from the lower metaphysis of the femur. The mass on the inner aspect of the left leg seemed to spring from the lower metaphysis of the tibia. There was a small mass on the inner aspect of the right tibia.

On the dorsum of the hand, over the metacarpals and phalanges, there were small, nodular, sessile masses.

Fig. 30. Case 7. There was marked widening of the lower metaphyses and tibiæ, with spur-like formations; there was also deformity in the metatarsals.

None of the masses described was adherent to the skin, nor was any one of them movable. No pain was associated with any of these masses, and, with the exception of the one on the inner aspect of the left femur, none was so located as to disturb the patient a very great deal.

The diagnosis was dyschondroplasia (Figs. 31-39).

X-ray films were made of the entire skeleton. The films of the chest show involvement of ribs, both scapulæ, and both humeri. Below the glenoid fossa and near the angle of the scapulæ, there were distinct, irregular, elevated lesions. The head of the right humerus was larger than the left. The upper three inches of the diaphysis of the right humerus was broader than the left. There was, apparently, an attempt at proper tubulation of the upper portion of the shaft of the right humerus, as evidenced by a line suggesting a portion of the normal cortex, but this was covered by a large, less dense, area of bone. If one had not seen other evidences of disturbance, he would have been inclined to think that a fracture had occurred in this region at some time in the past. The upper portion of the left humerus showed a marked vacuolization and there was a fusiform enlargement of the upper portion of the middle third of the shaft. There was no evidence of disturbance at the lower end of either humerus.

There were a number of exostoses on the ribs; particularly on the left side there was a large pedunculated mass which was much less dense than the surrounding bone. This sprang from the fourth rib. On the left

Fig. 31. Case 8. Dyschondroplasia. Physical examination showed a large mass on the inner aspect of the left femur and one on the inner aspect of the left ankle.

there was a smaller mass springing from the fifth rib.

When comparing the films of the two hands and forearms, one noticed that the right hand was much larger than the left. All of the metacarpal bones and phalanges were larger on the right than on the left. There were exostoses on the phalanges, as well as the metacarpals on the right hand. The right radius was about 0.75 inch longer than the left and there were spur-like projections which sprang from the lateral aspect of both radii and ulnæ. There was bowing of both radii and ulnæ on the right side. The lower end of the left radius showed a wide metaphysis and a small spur-like projection on the ulnar aspect, as well as a spur-like projection about the middle third of the shaft on the outer side of the radius. The ulna was shorter than the radius by about 0.5 inch. There was a wide metaphysis and a deformed lower end. The lower epiphysis was fused to the metaphysis in an oblique direction.

Examination of the films of the pelvis showed sessile growths springing from the crest of the ilium on both sides, and broad, flat, pubic arches which looked as though the patient barely escaped the additional defect of exstrophy of the bladder. There was a bilateral coxa vara. The neck of the femur, particularly on the left side, was extremely broad, in fact, it was almost as broad as the distance between the tips of the greater and lesser trochanters.

There was a very wide metaphysis of the lower end of the right femur with a horny projection at the lower end of the diaphysis. There was a wide metaphysis at the upper end of the tibia and a spur-like projection on the mesial aspect. The metaphysis of the upper end of the fibula, the head was distorted and there was, apparently, a large sessile growth between the tibia and fibula.

On the left side, the lower metaphysis of the femur was wide; on the mesial aspect of this metaphysis there were two pedunculated growths or exostoses. The density of one of these was irregular and vacuolated. The metaphyses for the upper end of the tibia and fibula were likewise very wide.

Examination of both knees showed wide fusiform lower metaphyses of the fibulæ. The metaphysis for the lower end of the tibia did not seem to be as wide as that of the fibula.

Operation was suggested for the removal of the large mass in the inner aspect of the left femur and the one springing from the fourth rib on the left side. The patient was

advised to have others removed at a later date.

Operation.—Operation was performed on Nov. 4, 1931. An incision was made over the large mass on the inner aspect of the femur. The muscles were found to be very thin at the apex of the mass. The muscle tissue was retracted from the tumor and its base was separated from the metaphysis by a sharp Campbell gouge. The rough edges were removed with a rongeur. Bone wax was used to control bleeding. The muscles were approximated and the skin closed.

At the same operation, we removed a small growth from beneath the left breast, which we found originated from the fourth rib. The pedicle was separated from the rib with a Campbell gouge. After bleeding was controlled, the tissue planes were approximated and the skin closed with interrupted dermal suture material.

The patient made an uneventful recovery from this operation.

This case provides additional evidence for the belief that the retardation phenomena which are responsible for the complete and partial retardation of tubulation must have occurred either in the developmental period or have been the result of a disturbance of the germ plasm.

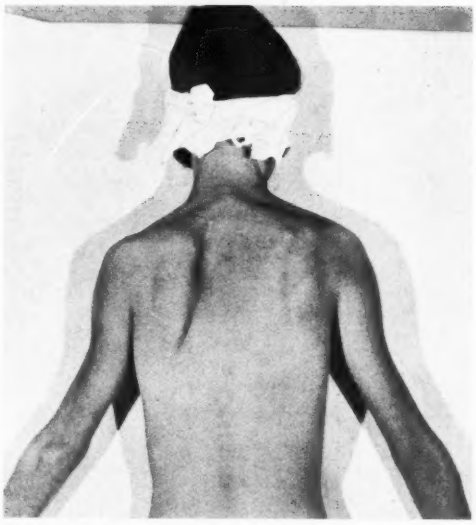


Fig. 32. Case 8. There was involvement of both scapulæ and humeri.

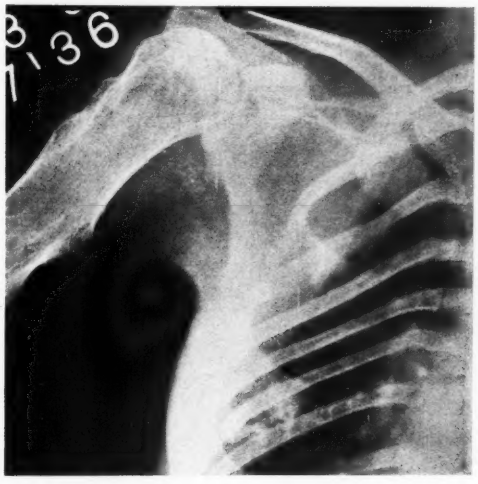


Fig. 33. Case 8. Involvement of the ribs, scapula, and humerus.

CONCLUSIONS

1. Skeletal deformities and defects are due to retarded development at a particular period.

2. Fanciful theories making amniotic bands responsible for deformities should be discarded.

3. Congenital deformities are in many cases recessive and not dominant.

4. The theory of primogeniture is no longer tenable.

5. Clinical observations in cases of a three-phalanged thumb indicate that the metacarpal had disappeared in the process of evolution. What is ordinarily considered the first metacarpal is in all probability a first phalanx. This view is strengthened by the fact that the epiphysis of the so-called first metacarpal is at the proximal end—the position occupied by the epiphysis of the

other phalanges—whereas the epiphysis of the other metacarpals is at the distal end.

6. There is no reason to attempt to classify hereditary defects, as they can be legion.

7. A single operation for the relief of syndactylism, when complete, should not be attempted.

Fig. 36. Case 8. The pelvis showed growths on the crests of the ilia, coxa vara, and broad necks of the femora.

8. Polydactylism is of more than passing interest to the surgeon, particularly if there is a double thumb or great toe. In the case of the thumb it is most important to differentiate because of the musculature by which opposition of the thumb is accomplished.

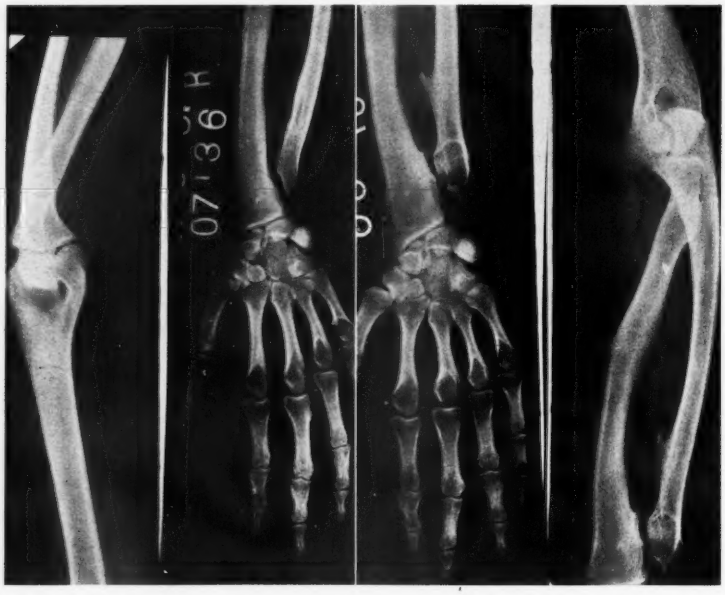


Fig. 34 *(left)*. Case 8. Right upper extremity.
Fig. 35 *(right)*. Case 8. Left upper extremity.

9. Hypodactylism, syndactylism, absence of carpal bones, and the absence of the shaft of the fibula in a single case bear testimony to the truth of the oft repeated statement that many defects are usually present in the same patient. Such cases indicate that there must be a developmental arrest responsible for the disturbance.

10. The clinical cases reported in the first group include syndactylism, polydactylism, hypodactylism, fusion of carpal bones, absence of carpal bones, defect of the fibula, ectromelia, and a three-phalanged thumb.

11. Dyschondroplasia and other congenital deformities are identical in origin.

12. Dyschondroplasia is the result of an

arrest of development of one or more of the processes necessary for bone growth and development.

13. Retardation of tubulation results in wide metaphyses.

Figs. 37 and 38. Case 8. Right and left knees, respectively.

14. Partial retardation of tubulation results in exostoses.

15. Exostoses are not essential to dyschondroplasia, but incidental.

16. Dyschondroplasia may be limited to a single bone, or it may involve all bones except the skull.

17. Jansen's theory of dissociation explains all of the phenomena which are found in dyschondroplasia.

18. Operation is indicated only in the pedunculated or sessile masses which interfere with function.

BIBLIOGRAPHY

(1) Ashhurst, A. P. C.: Multiple Cartilaginous Exostoses (Hereditary Deforming Chondrodysplasia). Ann. Surg., 1916, LXIII, 167.
(2) Bagg, H. J.: Am. Jour. Anat., March, 1929, XLIII, 167-219.
(3) Idem: Am. Jour. Obst. and Gynec., August, 1924, VIII, 131-141.
(4) Boggs, T. R.: Johns Hopkins Hosp. Bull., 1913, XXIV, 210.
(5) Campbell, H. E.: Hereditary Deforming Chondrodysplasia. Jour. Bone and Joint Surg., 1925, VII, 982.
(6) Carman, R. D., and Fisher, A. O.: Ann. Surg., 1915, LXI, 142.
(7) Cleveland, M.: Surg., Gynec. and Obst., September, 1928, XLVII, 338-345.
(8) Cole, W. H.: Chondrodysplasia. Surg., Gynec. and Obst., 1926, XLII, 359.

(9) Coon, C. E.: Dyschondroplasia. Am. Jour. Orth. Surg., 1911, IX, 604.
(10) Cooper and Travers: Surgical Essays, p. 128. 1st Amer., 3rd Lond. Ed. Webster, 1821.
(11) Cotton, F. J., and Chute, A. L.: Boston Med. and Surg. Jour., 1898, CXXXIX, 210.

Fig. 39. Case 8. The wide metaphysis at the lower end of the fibula.

(12) Curshman: Chondrodystrophia. Endocrinologie, IV, 161-176.
(13) Davis, G. G.: Am. Jour. Orth. Surg., 1905, III, 234.
(14) Dittrich, R. J.: Human Biol., May, 1929, I, 278-282.
(15) Ehrenfried, A.: Jour. Am. Med. Assn., 1915, LXIV, 1642.
(16) Idem: Jour. Am. Med. Assn., 1917, LXVIII, 502.
(17) Fairbanks, H. A. T.: British Jour. Surg., 1924.
(18) Geschickter, C. F.: Fibrocartilaginous Tumors of Bone. Arch. Surg., August, 1931, XXIII, 215-328.
(19) Gibney, V. P.: Multiple Exostoses. Med. Rec., New York, 1875, X, 300.
(20) Idem: Multiple Exostoses. Med. Rec., New York, 1879, XV, 589.
(21) Idem: Hereditary Multiple Exostoses. Am. Jour. Med. Sci., 1876, LXXII, 73.
(22) Gossage and Carling, R.: Proc. Royal Soc. Med., 1910, IV, Pt. 2.
(23) Hyndman, O. R.: Arch. Surg., July, 1930, XXI, 12-31.
(24) Jansen, Murk: Feebleness of Growth and Congenital Dwarfism. Oxford Med. Publications, 1921.
(25) Idem: Achondroplasia, Its Nature and Its Cause. Bailliere, Tindall and Cox, London, and Brill, Leiden; also Jones Birthday Volume, 1928, pp. 43-71.
(26) Keith, Sir Arthur: The Nature of the Structural Alterations in the Disorder Known as Multiple Exostoses. Jour. Anat., 1919-1920, LIV, 101.
(27) Idem: Lancet, Nov. 7, 1874, 657.
(28) Lewin, P.: Surg., Gynec. and Obst., 1927, XLV, 48.
(29) Macklin, M. T.: Human Biol., September, 1929, I, 382-405.
(30) Marshall, H. W.: Am. Jour. Orth. Surg., 1916, XIV, 346.
(31) McFarland, J.: Surg., Gynec. and Obst., February, 1929, XLVIII, 268-273.
(32) Percy, N. M.: Surg., Gynec. and Obst., June, 1915, XX, 619.
(33) Perkoff, D.: British Med. Jour., Aug. 25, 1928, II, 341, 342.
(34) Potel, G.: Congenital Malformations of the Limbs. Rev. de chir., 1914, XLIX, 293-326, 623-648, 822-858.
(35) Snyder, L. H.: Jour. Hered., February, 1929, XX, 73-77.
(36) Stockard, C. R.: Am. Jour. Anat., 1920-1921, XXVIII, 116.
(37) Struthers: Edin. New Phil. Jour., 1863, LXXXIII.
(38) Thomsen, O.: Acta Path. et Microbiol. Scandinavia (Supplement), March, 1928, V, 148, 149.
(39) Travers, B.: Further Enquiry Concerning Const. Irritation, Longmans, 1835, p. 285.
(40) Tubby, A. H.: Congenital Deformities, 1912, I, 103-105.
(41) Idem: Deformities, Including Diseases of Bones and Joints. II, plate 24, p. 573.
(42) Vaughn, P. T.: Trans. Western Surg. Assn., St. Louis, 1913, VIII.
(43) Idem: Abst. Jour. Am. Med. Assn., Jan. 17, 1914, LXII.
(44) Wahren, H.: Multiple Cartilaginous Exostoses. Acta Orth., Scandinavia, 1930, I, 236-244.
(45) Whitman, Royal: Orthopedic Surgery. Lea and Febiger, Philadelphia, 1910.
(46) Willard, F.: Trans. Am. Orth. Assn., 1900, XIII.
(47) Windle, B. C. A.: Jour. Anat. and Physiol., 1891-1892, XXVI, 100.
(48) Withington, C. F.: A Case of Multiple Symmetrical Exostoses. Boston Med. and Surg. Jour., 1907, XLVI, 200.

NOTE ON INTERNATIONAL COMPARISON OF X-RAY STANDARDS

By LAURISTON S. TAYLOR, Bureau of Standards, WASHINGTON, D. C.

A RECENT paper[1] gave a description of comparisons of the Bureau of Standards X-ray ionization standard with that of the National Physical Laboratory, Physikalisch-technische Reichsanstalt, and Le Service d'Etalonnage de l'Hôpital St. Antoine. In these comparisons it was necessary in all cases to make corrections for the absorption of X-rays in air, for which absorption coefficients were obtained by extrapolation from available data. These coefficients are, as pointed out, uncertain. Unfortunately, corrections for this paper, suggested by Dr. Kaye, were received after it was too late to insert them. He informs us that their recent determinations of the air absorption correction under the conditions used in the comparisons give values somewhat different from those used in the published paper. For 110 K.V. unfiltered radiation Dr. Kaye finds a correction of 2.2 per cent as against 1.5 per cent used in the published paper. For 143 K.V., 1.4 mm. copper, his correction agreed with the published value. Applying the first correction raises the values of the N.P.L. determination by approximately 0.7 per cent.

[1] L. S. Taylor, Bureau of Standards Jour. Research (R.P. 397), 1932, VIII, 9-24: RADIOLOGY, January, 1932, XVIII, 99-114.

When Kaye's values are used, Column 11, Table III, of the published paper becomes—

Average difference of intact systems	—1.0%
Corrected for compensator differences	+0.5%
Average difference when using the same diaphragms	—1.9%
Corrected for compensator differences	—0.4%

The resulting N.P.L. values for the magnitude of the roentgen, as given in Table IX, Column 4, is—

1.005 when corrected for diaphragm differences

0.996 when using the same diaphragm on both chambers

1.001 when averaging all readings taken.

We would also call attention to an error *(Bureau of Standards Journal of Research,* Table III, p. 16, line 3: RADIOLOGY, p. 106, line 19). The sentence should read: "Runs No. 1 and No. 3 are straightforward comparisons; Run No. 2 was made with the tube diaphragm increased in diameter from 12 to 30 millimeters."

HOW WE MAY REDUCE THE NUMBER OF MALPRACTICE SUITS

By I. S. TROSTLER, M.D., F.A.C.R., F.A.C.P., CHICAGO

IF we can materially reduce the number of malpractice suits filed, we will, as a matter of course, reduce the number to be contested in the courts and the number of verdicts with judgments to be paid, and so, in an indirect and roundabout manner, reduce the premium rates of our malpractice insurance.

From even a casual observation, it is quite clearly evident that malpractice suits are greatly increasing in number and frequency. While the direct cause of this is not clearly patent, much of the increase is correctly attributed to what may well be called malicious tongue wagging. Any one who comes much in contact or has any considerable experience with malpractice suits, knows that too freely discussing the merits and demerits of fellow-practitioners and competitors, with or in the hearing of patients, tends markedly toward the instigation of malpractice suits. In no other profession is this practice so prevalent as it is among physicians. It is practically unheard-of in the various irregular healing cults, but it seems to be on the increase in the regular medical profession. This condition can and should be remedied by organized medicine, by prompt and radical action against these tongue-wagging and innuendo-uttering physicians. If a few suits for slander were filed against the men who instigate the malpractice suits, it would cause some of them to think a second time before making disparaging remarks about their confrères or competitors. Such action would go far toward curbing the malicious gossip of many who are far too ready to say and do things that tend to disparage the actions and practices of their fellow-practitioners. Let us make an example of the physicians who maliciously talk about other physicians' ability, practices, or conduct of their practice. Make them prove what they allege or pay for their libel. Let us broadcast that we are going to do that and warn them of what we propose to do.

Another important consideration in the prevention of adverse decisions and verdicts against physicians is that practically no malpractice suits can be won without expert testimony that the acts complained of are irregular, wrongful, and constitute conditions recognizable as malpractice. If it were impossible to secure this expert medical testimony, not many malpractice suits could be or would be successful and the legal profession would not be so ready to take the cases and so frequently able to prosecute them to a successful termination.

Here is another potent and powerful means of reducing the number of suits filed and verdicts rendered against our brethren. Let us make it unpopular for any physician to instigate suits or to lend aid by furnishing expert testimony in prosecution of these suits, in that way lessening their frequency and consequently reducing our insurance premiums. *Operæ pretium est.*

REPORTS OF CASES OF INTEREST TO RADIOLOGISTS

DISCOVERIES AS TO ROENTGENOGRAM NOT GROUND FOR NEW TRIAL

(Caldwell *vs.* Hoskins *et al.* (Ore.), 186 Pac. R. 50)

The Supreme Court of Oregon, in affirming a judgment in favor of the plaintiff for damages for personal injuries, says that the defendants filed a motion for a new trial based on affidavits to the effect that a few minutes before the jury returned the verdict the attorneys for the defendants learned of

a rumor that the plaintiff had caused a roentgenogram to be taken; that there was no opportunity to verify the rumor until after the verdict was received; that afterward the defendants ascertained that the plaintiff had gone to a roentgenologist, who took a roentgenogram of her spinal column and ribs which showed that there had never been any injury to the spine and ribs, and that the roentgenologist informed her that she had not sustained any injury to her spine or ribs. The defendants contended that a new trial should have been granted because (1) the plaintiff was guilty of misconduct in suppressing and concealing the roentgenogram, and because (2) the roentgenoscopy constituted newly discovered evidence which the defendants could not with reasonable diligence have discovered and produced at the trial. But the evidence about the rib and spine affected the amount of the verdict rather than the right to a verdict. The roentgenoscopy was not made until six months after the date of the injury. The roentgenogram was not made a part of the record or exhibited to the trial judge. There was no affidavit by the roentgenologist, notwithstanding the fact that the plaintiff testified as a witness in her own behalf, and by doing so consented that the physician might testify as a witness. While the court does not intend to decide whether the trial judge could have compelled the plaintiff to submit to an examination on the application of the defendants, yet the court may with propriety note the fact that the plaintiff was not requested to permit physicians chosen by the defendants to examine her condition, and, so far as the question of her injury was concerned, the defendants were apparently willing to rest their whole case on the testimony of one physician and of one of the nurses at the hospital. The plaintiff was a witness in her own behalf, and she was cross-examined. The defendants had ample opportunity to inquire as to whether or not any other physician had examined her and whether a roentgenogram had been taken, and yet no such inquiries were made. In view of the fact that the defendants did not take full advantage of the opportunities offered by cross-examination, and in view of the other facts shown by the record, the court does not think it would be justified in reversing the trial court and holding that he should have allowed a new trial on the ground of newly discovered evidence. Nor does the court think that it could fairly be said that the plaintiff was guilty of suppressing evidence. She knew whether she suffered any pain, and she also knew where the seat of the pain was. So overwhelming was the evidence that it might be said to have conclusively established that she suffered pain in the side. The physician who examined her on the evening of the accident stated that he did not discover any broken rib or twisted spine. The physician who called on her five days afterward and from that time on acted as her attending physician testified that her rib was broken and that her spine was twisted. The roentgenogram was not taken until six months after the accident, and, for aught that appeared in the record, the broken rib, if there was one, might have completely united, leaving no evidence of a former break. The court was not advised as to whether medical men would say that a break either sometimes or always leaves evidence of the break which a roentgenogram will invariably picture; nor does it know how serious the break must be in order to leave permanent evidence of the fracture. If the plaintiff's rib was broken, it might be that it was a slight break, and no evidence of the fracture remained when the roentgenogram was taken. The plaintiff was not bound to believe the opinion of the physician who took the roentgenogram six months after the accident; but, knowing that she actually suffered pain, and having been told by her attending physician that her rib was in truth broken, she had a right to believe, as she undoubtedly did, that her rib

was broken, and she was under no obligation to call the roentgenologist as a witness merely because his opinion, based on an examination made six months after the injury, differed from the opinion of her attending physician.

A CELEBRATED CASE: LIABILITY FOR ROENTGENOGRAPHIC BURN—"RES IPSA LOQUITUR"—CARE REQUIRED

(Holt *vs.* Ten Broeck (Minn.), 159 N.W.R. 1073)

The Supreme Court of Minnesota affirms a judgment for $2,500 damages in favor of the plaintiff for injury from a burn alleged to have been caused by the negligence of the defendant in taking a roentgenogram. The court says that, in February, 1915, the plaintiff was under treatment for some trouble in her hip supposed to be a fracture or a dislocation. Her attending physician desired a roentgenogram. The defendant, a regularly licensed physician, took it. A few weeks afterward a sore developed on the plaintiff's hip which it was claimed was the result of a roentgenographic burn. The evidence was sufficient to sustain a finding that the roentgen ray caused the sore. The testimony of the plaintiff was that there was none before. It was at the point of the exposure. There was medical testimony having a tendency to prove that it came from a roentgenographic burn. The question was for the jury. To recover damages it was necessary that the plaintiff prove negligence in the defendant. There was little direct evidence of negligence. The plaintiff claimed that during the progress of the taking the defendant made some exclamation to the effect that the machine was not working right. Her claim was that the exposure was unduly long, but her testimony did not strongly support it. A physician sufficiently qualified to give an opinion as an expert stated that a proper application of the rays would not produce the result which he found. The evidence was that with a proper machine and with a proper use of it a burn is unusual. There was evidence that the machine was a proper one. The machine and its operation were wholly under the control of the defendant. Under such circumstances the rule of *res ipsa loquitur* (the matter speaks for itself) applies. It did not follow from this, as the plaintiff's counsel argued, that the burden shifted to the defendant of proving freedom from negligence. *"Res ipsa loquitur,* where it applies, does not convert the defendant's general issue into an affirmative defense." The language quoted was approved in a case in which this court held that the *res ipsa loquitur* rule merely permits the jury to draw an inference of negligence, and "the jury is to consider and weigh the inference, in the light of all the facts and circumstances, and give it such weight as tending to prove negligence as they deem it entitled to." It does not follow from what is here said that the *res ipsa loquitur* doctrine applies to a bad result or mishap coming from a physician's treatment. The rule does not apply in such cases. In determining negligence it can make no difference whether the one operating the roentgenographic appliance is a physician or a lay expert. The care required is ordinary care. It is the care exercised by and to be expected from one reasonably skilled in the use of the appliance. The rays were not applied for curative purposes, but to obtain information. This is the logical if not the necessary result of the holding in Henslin *vs.* Wheaton, 91 Minn. 219, 97 N.W.R. 882, that in an action against a physician for negligence in the use of a roentgenographic machine he was not entitled to have the question of his skill determined by physicians of his own school. A physician who qualified himself as an expert in the application of the roentgen ray was permitted to give his opinion, based on the result of the operation, that the application was improper. This was not error. The

verdict was for $2,500. The defendant claimed that it was excessive. The trial occurred a year after the injury. After the injury developed the plaintiff wandered from doctor to doctor for several months. Finally she went to the hospital. She was there six months. The pain had been considerable. At the time of the trial, so her claim was, she was unable to work. The sore was still open and of considerable extent. One physician said it was uncertain whether it would be permanent. The verdict was not excessive.

STANDARDS FOR TREATMENT WITH ROENTGEN RAYS

(Hunter *vs.* Burroughs (Va.), 96 S.E.R. 360)

The Supreme Court of Appeals of Virginia, in a lengthy opinion, affirms a judgment in favor of plaintiff Burroughs for damages alleged to have been occasioned to him by the alleged malpractice of the defendant, a physician, in the treatment with roentgen rays of eczema with which the legs and ankles of the plaintiff were affected. The Court says that it should be borne in mind that the case involved two standards of professional skill and care by which the evidence as to the competency and the conduct of the defendant was to be measured; one standard having reference to the technic or mechanical operation of the roentgen-ray apparatus, and the other standard having reference to the possession and use of the professional skill and care incumbent on the defendant with respect to the diagnosis and treatment of the disease of the plaintiff in matters other than the mere mechanical operation of the apparatus.

The two standards mentioned both involved, in this case, the highly specialized art of the treatment of the disease of the plaintiff by roentgen rays; and, so far as they did so, expert testimony before the jury fixing such standards was essential to the support of the verdict of the jury, since otherwise the jury, to the extent of the questions involving such specialized art, would have had no standard in mind by which to measure the other facts proved in the case. Now, as to the mechanical standard of skill and care, there was no expert evidence in the case except the testimony of the defendant and of other expert witnesses for the defendant; but there was sufficient evidence in the case, when measured by the mechanical standard fixed by the testimony of the defendant, to support the verdict of the jury. It is deemed sufficient to mention only the following details of such evidence: There was evidence in the case to the effect that the defendant did not keep an accurate record of the roentgen-ray treatment or any record of the exact "dose" of roentgen rays applied in the several treatments therewith; that if only the standard "dose" had been applied, it was extremely improbable that any bad result would have been caused. The cross-examination of the defendant tended to show that his memory of the "dose" applied by him in the several treatments was not to be relied on. There were inconsistent statements made by the defendant at different times as to his opinion of the causes of the bad result; and there was other evidence to support a conclusion of the jury that the "dose" in fact applied was not in accordance with the mechanical standard fixed by the expert testimony of the defendant himself. It was true that such testimony did not show that the bad result might not have happened without fault of the defendant; but there was sufficient of such evidence, the credibility and weight of which was for the jury, tending to show that the bad result was more probably due to lack of skill or negligence of the defendant as charged. This degree of proof is all that is required of a plaintiff in a civil case. He is not required to exclude by his proof the possibility of the result complained of hav-

ing been due to causes for which the defendant is not responsible.

The cause of the injury being the roentgen rays was, however, but one element of fact in the case. As the jury was properly instructed, if the defendant exercised ordinary care and skill in the premises, the plaintiff was not entitled to recover damages, although the injuries complained of were caused by the roentgen-ray treatment; and the question still remained whether the defendant did or did not exercise such care and skill. The Court thinks there was sufficient evidence in the case, when measured by the general professional standard, as well as by the mechanical standard of skill and care, to support the verdict of the jury.

It was correct to say that the standard by which the duty of the defendant to make the preliminary tests and examination of the patient before subjecting him to the roentgen-ray treatment had to be tested was whether other like specialists in good standing, in the same or similar localities as the defendant, would have been guilty of the omission to make such preliminary tests and examination, which test had to be applied by measuring the evidence, as it might be introduced on the trial, by the standard fixed by the testimony of experts on the subject. Failure to warn of danger in the treatment was not necessarily negligence, unless there was an assurance of a cure.

AN IMPORTANT DECISION: PHYSICIANS NOT REQUIRED TO REPORT TO DEFENDANTS

(Tutone *vs.* New York Consolidated R. Co. (N. Y.), 177 N. Y. Supp. 818; Herbert *vs.* Brooklyn Heights R. Co., (N. Y.) 177 N. Y. Supp. 901)

The Kings County, N. Y., court holds in these two personal injury cases that orders for the physical examination of the plaintiffs by physicians were erroneous in requiring that the reports of the physicians should be given to counsel for the defendants. The decisions are by two different justices. In the Herbert case, Justice May says there is nothing in the New York statutes which directs or requires a report to be made by the examining physician. The sole object of the statute in permitting physical examinations is to reduce the likelihood of fraud being practised to a minimum, by granting the right to the defendant to compel the plaintiff merely to submit to such physical examination at the hands of the physicians, so that testimony thereof may be given on the trial. While it has been customary for physicians so appointed to make a report and deliver it to the defendant, there is no authority apparently in the law therefor. There may be no objection, perhaps, to the disclosure by the physician to the defendant of the results of his examination, but the court has no power to direct him to make such report, and therefore it follows that there can be no direction to deliver a report to the defendant, or to file a report in the office of the county clerk.

EFFECT OF RECEIVING CHECK "IN FULL OF ACCOUNT"

(Booth *vs.* Dougan (Mo.), 217 S.W.R. 326)

The St. Louis (Mo.) Court of Appeals affirms a judgment in favor of the defendant, who was sued by a physician for a balance of $447 claimed to be due on account after the physician had indorsed and collected through the bank a check for $200 reading "In full of account to date," which the defendant had sent to him. The Court recognizes the rule to be that when a certain sum is due from one to another, the payment of a lesser sum is no discharge as to the remainder, notwithstanding an agreement to that effect, because the latter agreement is without consideration. But such rule, the Court says, does not apply when the amount due is disputed or unliquidated. When a claim is unliquidated, any sum, no matter how small, given and received in

satisfaction of the demand, will legally satisfy it, however large the claim may be. A debt or demand is liquidated when agreed on by the parties or fixed as to the amount by the operation of law. The account in this case was made up of charges for visits made by the plaintiff, as a physician in attendance on the defendant and his family, from Nov. 4, 1911, to May 30, 1915, and totaled $1,347, on which payments were credited, of $200 in 1912, $200 in 1913, $300 in 1914, and $200 in 1915. It was admitted at the trial that it was not necessary for the plaintiff to prove each of his items in detail, but that it would be conceded that he would testify to the correctness of each item. The defendant contended, however, that the last payment was made by him and accepted by the plaintiff as in full of all amounts due the plaintiff. In no sense could this be said to have been a liquidated account. While it was true that the defendant did not dispute that the services had been rendered and that the charges made for them were reasonable, he nowhere admitted that he owed them. On the contrary, when his attention was called to the account rendered just before he sent his check for the last payment, he called the plaintiff's attention to the fact that they had before settled on a compromise basis and proposed to do that here; and on the plaintiff's stating that his account was about $400, the defendant stated that he would pay $200 if the plaintiff would accept that in full. It was true that the plaintiff denied this conversation over the telephone, but that was for the jury, the defendant having distinctly testified to it. It was under these circumstances that the defendant made out his check for $200, writing on it that it was in full, transmitted it by letter, calling attention to that sum, and the plaintiff accepted the check and cashed it. Under these circumstances the plaintiff was bound by his act and could not claim anything over and above the $200. His reception and retention of the $200 in full payment of his account, that not being a liquidated account, or an account stated, was conclusive on him.

DOCTRINE THAT AN ORDINARY PHOTOGRAPH IS THE BEST EVIDENCE OF WHAT IT CONTAINS DOES NOT APPLY TO RADIOGRAPHS. EXPERT OPINION THE ONLY EVIDENCE TO BE CONSIDERED[1]

Marion *vs.* Coon Construction Co. (New York), 1913, Third Department, Vol. 157, App. Div. 95

This was an action to recover damages for personal injuries sustained by the plaintiff, who was struck by a boom while signaling the engineer controlling the operation of the derrick. The jury found a verdict for the plaintiff and the defendant appealed from a judgment entered on that verdict. The judgment was affirmed.

One of the errors alleged by the defendant on the appeal related to the failure of the plaintiff to produce X-ray pictures concerning which expert witnesses for the plaintiff testified: On this point the Court said at page 99:

A careful reading of all the medical evidence and the other evidence as to injuries will show that the plaintiff was substantially injured. One of the plaintiff's witnesses, Dr. Gardner, swears: "I was present when the (X-ray) pictures were taken, saw them taken, saw them developed, and looked at the plates immediately after they were developed." Thus their identity and correctness were established. Then the Doctor proceeds to tell what the pictures show. Another physician, Dr. Tinker, also tells what he thinks the plates show. There was no demand made by the defendant for the production of the plates; no hint or suggestion that they were desired. They were, in fact, in court, so the plaintiff states in his brief. I can see no error at all in this X-ray incident. *The evidence*

[1]Received from Leon T. LeWald, M.D., New York City.

shows that nobody but an X-ray expert could tell anything from the plates, and that if they had been produced they would have done the court, jury, or the defendant's ordinary physicians no good. *I do not think that the doctrine that an ordinary photograph is the best evidence of what it contains should be applied to X-ray pictures. They constitute an exception to the rule concerning ordinary documents and photographs,* for the X-ray pictures are not, in fact, the best evidence to laymen of what they contain. Generally, they are no evidence at all, signifying nothing whatever except to the expert. *The opinion of the expert is the best evidence of what they contain—the only evidence.* If there had been a demand for these pictures in court, or a request that they be submitted to the inspection of the opposing experts, and these rights had been denied the defendant, such an error would be serious. But whatever harm befell the defendant, if there was any harm at all, came to it by reason of its own failure to demand what it was entitled to, and what it would unquestionably have received by the mere asking. To sustain this contention of the defendant would be to tolerate worse than a technicality —a trick.

PROPER TIME FOR ROENTGEN-RAY EVIDENCE

(Van Tinder *vs.* Birmingham Railway, Light & Power Co. (Ala.), 80 So.R. 858)

The Supreme Court of Alabama, in affirming a judgment in favor of the defendant in this personal injury case, says that the plaintiff urged that a new trial should be granted because of newly discovered evidence resulting from a roentgen-ray examination of her back showing the nature and character of her injury and its probable cause. But the Court does not think that this was a good ground for granting a new trial, for one reason, because it is not persuaded that due diligence was shown in obtaining this roentgen-ray examination. The plaintiff relied, among other things, on permanent injuries to her spine, and it was but fair to herself, the defendant, and the court that she should have obtained and produced the best evidence on the subject; and the reasons for resorting to a roentgen-ray examination were as important before as after the trial. It is a matter of common knowledge that in cities the use of the roentgen ray for the discovery and diagnosis of internal injuries and abnormal conditions of the human body is of common occurrence. True, it may incur some trouble and extra expense, but the trouble and expense should be no greater before than after the trial, and the reasons and necessities for them should be as imperative for the original trial as for upsetting or overturning the verdict of a jury after it has passed on the issue to which the examination relates and which was contested on the trial.

CASE REPORTS AND NEW DEVICES

LYMPHOSARCOMA OF THE FEMUR

By E. A. POHLE, M.D., PH.D., and GORTON RITCHIE, M.D.
MADISON, WISCONSIN

From the Departments of Radiology and Physical Therapy and Pathology, University of Wisconsin Medical School

H. E. R., male, aged 30 years, fractured the left femur just above the knee on March 2, 1931, while walking in the woods. The leg was put in traction for five weeks. He stayed in the hospital for another week and was then discharged. On May 14, 1931, he refractured his leg while in bed and returned to the same hospital, where Lane plates were inserted on May 20, 1931. One week later the wound started to drain and two drains were inserted on July 1, 1931.[1]

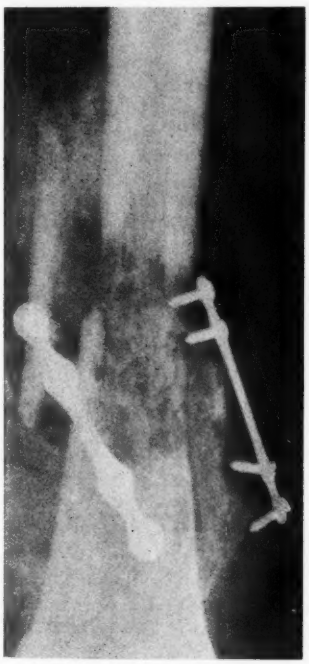


Fig. 1. Roentgenogram of femur.

[1]We were unable to obtain roentgenograms taken before the patient came to us.

He entered the University Hospital in Madison on the Orthopedic Service on Aug. 8, 1931, with the probable diagnosis of nonunion of fracture of left femur with secondary osteomyelitis.

The general physical examination revealed that the patient was considerably emaciated and anemic. There were tender swollen bony masses over the head of the right radius, over several ribs, and also on the right parietal bone. There was also a draining sinus in the mid-portion of an old surgical incision on the anterior aspect of the left lower thigh. The latter was considerably swollen and very tender. Motion

Fig. 2. Roentgenogram of the right arm, showing lesion in radius.

could be felt at the site of the fracture. Roentgenographic examination (Fig. 1) showed an old fracture of the left femur approximately 6 inches above the knee, held by two Lane plates, without union. While the presence of productive bone changes suggested osteomyelitis there were also several areas of destruction which indicated in all probability a metastatic malignancy. The latter impression was borne out by the fact that similar destructive lesions could be seen in the neck of the left femur, the right ilium, the right upper radius (Fig. 2), right parietal bone and fifth and sixth right and eighth left ribs. The only intimation as to the site of the primary lesion was found in the intravenous pyelogram, on account of which hypernephroma was suspected. All laboratory examinations were essentially negative except for a marked anemia. No Bence-Jones bodies were found in the urine. The patient failed rapidly, developed signs of cerebral involvement on Aug. 20, 1931, and died ten days later.

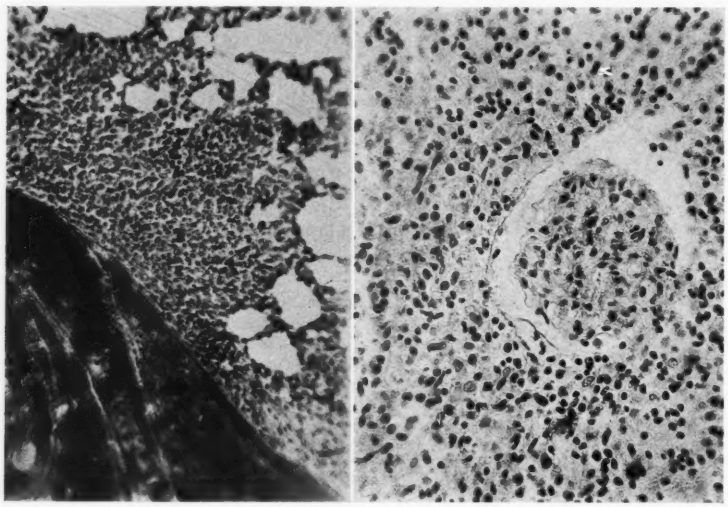


Fig. 3 *(left)*. Section of original tumor in left femur.
Fig. 4 *(right)*. Tumor nodule in kidney, showing surviving glomerulus.

AUTOPSY REPORT

The external description was similar to that recorded in the physical examination. The chief interest attached to the extent and distribution of the tumor growth. The left femur was fractured at about its midpoint, and besides a considerable degree of callus formation there was extensive tumor growth in and about the bone. The soft tissues were infiltrated and one nodule had appeared in the operative scar. There was widespread metastasis; several ribs were involved, the growth here being fusiform in shape and having eroded the bone so completely as to cause spontaneous fractures. There were flat neoplastic plaques in the subepicardial tissue. Both suprarenal glands were infiltrated, and nodules were found in each kidney. In the rectovesical septum there was a nodule about 4 cm. in diameter. No considerable lymph node enlargement was found anywhere in the body.

The tumor substance presented essentially identical characteristics wherever it was

examined. It was gray-white, somewhat vascular, and soft. Small areas of hemorrhage were noted, but nowhere was there extensive necrosis.

Unfortunately permission was not obtained for examination of the brain.

Microscopically, the tumor proved to be a lymphosarcoma (Figs. 3 and 4), with many types of cell, apparently all of the lymphoid series. It was felt that the primary site of the growth was in the left femur.

AN IMPROVED METHOD FOR THE ORAL ADMINISTRATION OF SODIUM TETRAIODOPHENOLPHTHALEIN FOR GALL-BLADDER VISUALIZATION

By LESTER LEVYN, M.D., and
A. H. AARON, M.D.,
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The oral administration of sodium tetraiodophenolphthalein is the method of choice among the great majority of roentgenologists. Menees and Robinson (1) were the first workers whose experiments, reported in 1925, resulted in the widespread use of the dye by mouth. The powdered dye was given in various types of enteric tablets and capsules, to withstand the attack of the gastric juices. In 1927, we published a method of administering the dye in solution (2). Since then, numerous soluble preparations have been available, and the use of the disodium salt in powder form, in tablets, or capsules, is almost obsolete.

Some of the preparations used are objectionable to patients because they are distressingly unpleasant to take, and reactions vary in degree from slight nausea to severe attacks of vomiting. Even in the more pleasant preparations, patients complain of the drinking of 200 c.c. or more of an astringent, acrid-tasting solution.

A standardized method of oral administration of the dye is obviously most desirable. With these facts in mind, we have evolved a method which has proved most satisfactory in our hands.

PREPARATION OF A SINGLE DOSE

Four grams of sodium tetraiodophenolphthalein are placed in a mortar, and 0.30 c.c. of hydroxysuccinic acid (COO H CH_2 CH (OH) COO H—malic acid) is added. The hydroxysuccinic acid prevents decomposition of the dye by breaking up the unstable disodium salt into the stable monosodium salt and sodium malate. Liquid petrolatum levis, in the amount of 3 c.c., is next added and the mixture thoroughly triturated. Two *elastic* gelatin capsules, such as various oils are dispensed in, of a capacity of 2.5 c.c. each, are then filled with this mixture by means of a pipette, and the aperture sealed with heat.[1]

The advantages of the use of these *elastic* capsules, prepared in this manner, are as follows:

1. The capsules are absolutely devoid of taste and are easily swallowed.
2. Nausea and vomiting are reduced to a minimum.
3. The dye is suspended in a finely divided state, and passes through the pylorus into the duodenum upon the disintegration of the capsules, which occurs (fluoroscopic observation) from one to two hours after they are taken. In many instances the capsules leave the stomach intact and are disintegrated in the small bowel.
4. This method makes available a standardized procedure.
5. Excellent gall-bladder visualization is obtained in children and adults.

[1]Owing to the fact that the filling and sealing of these capsules, by hand, is tedious and time-consuming, one of the chemical houses has kindly consented to manufacture them.

BIBLIOGRAPHY

(1) MENEES, THOMAS O., and ROBINSON, H. C.: Oral Administration of Sodium Tetrabromphenolphthalein; Preliminary Report. Am. Jour. Roentgenol. and Rad. Ther., April, 1925, XIII, 368, 369.

(2) LEVYN, LESTER, and AARON, A. H.: Cholecystography by the Oral Administration of Sodium Tetraiodophenolphthalein in Solution. Am. Jour. Roentgenol. and Rad. Ther., December, 1927, XVIII, 557-559.

CARCINOMA OF THE CERVIX WITH BONE METASTASIS

REPORT OF CASE

By RIEVA ROSH, M.D., Assistant Radiation Therapist. From the Radiation Therapy Service, Bellevue Hospital, New York City, Ira I. Kaplan, M.D., Director

Bony metastases associated with malignancy of the breast, prostate, and thyroid gland are of frequent occurrence. While direct pelvic extension or local metastases occur often, especially in neglected and untreated cases of carcinoma of the cervix, distant metastases from carcinoma of the cervix uteri, especially to bone, are very rare.

From the Mayo Clinic, Ford (1) reports 14 cases of bone metastases associated with carcinoma of the cervix, the tibia being involved in two cases. Albers-Schönberg reports 564 postmortem examinations of carcinoma of the cervix, 0.83 per cent of which showed metastases to long bones. Wertheimer reports 13 cases of metastases from carcinoma of the cervix, but only one case with involvement of both tibias. Jeaneney (2) reports one case of metastasis to the tibia from primary squamous-cell epithelioma of the cervix, Grade 4. Monad (4) reports one case of metastasis to the sternum from a carcinoma of the cervix.

In our series of 233 cases we have had only one case showing metastasis to bone.

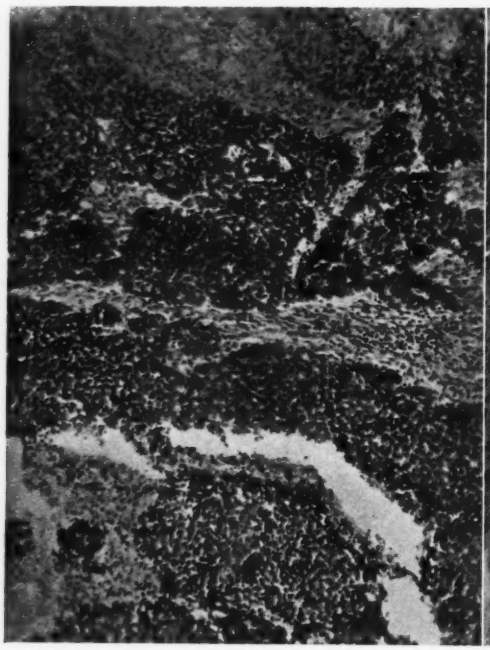

Fig. 1. Photomicrogram showing lesion of the cervix.

Fig. 2. Photomicrogram showing lesion of the tibia.

W. E., widow, white, 58 years of age, entered the gynecologic service of Bellevue Hospital, July 11, 1927, complaining of vaginal bleeding which had been apparent for six months. She had had two children, normal deliveries. The menstrual history, which began at 15 years, was regular, with no pain, of eight days' duration, moderate flow. The menopause was at 43 years. The bowels were regular. Six months previous to admission the patient, having noticed a bloody discharge following a hot douche, went to a doctor, who sent her to the hospital.

Vaginal examination showed an atrophic introitus with foul bloody discharge. The cervix was situated in the axis of the vagina, and was hypertrophied, eroded, and large. The fundus was retroverted, not outlined, and appeared small. The adnexa were negative. The Wassermann reaction was negative. Biopsy of the lesion showed a plexiform epithelioma.

The patient was advised to have radiation therapy and was treated with deep X-radiation to the pelvis and radium to the uterus and cervix. She received 860 r units of high voltage X-rays to the right and left anterior and posterior pelvic areas and 5,300 mc.-hrs. of radon. Following treatment the cervix lesion healed completely.

Until Nov. 22, 1929, the patient's general condition remained good, when she came to the clinic complaining of slight pain and swelling in the shaft of the left tibia. She gave a history of having had an injury to this leg several months previous to November, at which time the lump appeared and did not subside after applications of compresses. Gynecologic examination on Nov. 22, 1929, revealed a completely healed cervix; there was no bleeding or evidence of local metastasis or recurrence. On the left tibia a small tumor mass was palpable, firmly attached to the shaft.

An X-ray film of the tibia showed a large polycystic destructive area in the mid-third of the left tibia, 6 cm. in length, occupying the full width of the shaft with some irregularity of the cortex anteriorly. In the opinion of the roentgenologist, the findings did not suggest a malignant lesion but probably an osteitis fibrosa cystica or a giant-cell tumor.

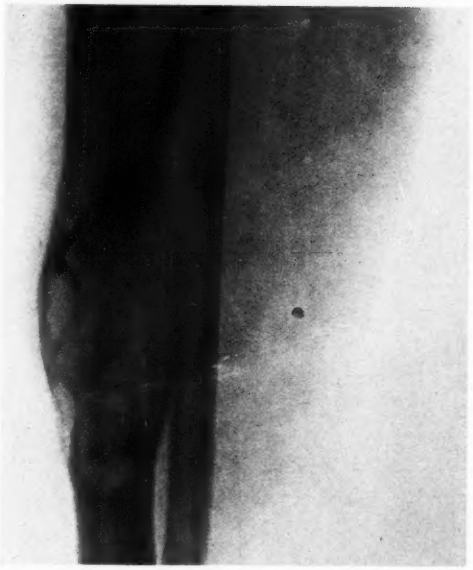

Fig. 3. Roentgenogram of the lesion in the tibia.

On account of the pain and the presence of tumor growth deep X-ray therapy was given to the leg. On Feb. 20, 1930, the swelling appeared larger. X-ray examination revealed at this time a polycystic neoplastic mass in the mid-third of the tibia which simulated the structure of a giant-cell tumor, more so than on the previous examination. On May 20, 1930, her general condition was good, but the patient complained of pain in the left leg. Radiographic examination showed a tumor mass present in the middle of the shaft of the left tibia, with evidence of widening of the shaft at this region, cystic formation in the medulla and cortex of the bone, with trabeculation characteristic of osteitis fibrosa cystica. A node, 1 cm. in diameter, was found in the left inguinal

area. Surgical removal of the mass was advised, to be followed by radium application.

The patient entered the hospital on June 2, 1930, and on June 6 the mass in the left tibia was excised. The pathologic findings were an extensive invasion of the bony structure of the left tibia at the mid-portion by a grayish-white, firm, soft tissue, with a necrotic center filled with mucopurulent fluid. The bone at this point was extensively infiltrated, and there was a pathologic fracture of the remaining lateral shell of the tibia.

The tumor mass was cleaned out, the bony cavity curetted and packed with gauze, a posterior molded plaster splint was applied, and the patient returned to the ward in good condition.

Microscopic examination of the removed tissue showed it to be plexiform epithelioma of the same type as that previously found in the cervix.

Further radium therapy was suggested, but the patient refused treatment and left the hospital on her own accord. Our social service worker followed the case at the patient's home and reported her condition as progressingly becoming worse. The patient was last seen in July, 1931, at which time she was very weak, was unable to leave her bed, and the leg was considerably swollen and painful.

CONCLUSIONS

1. Metastases in the long bones are often overlooked and are attributed to inflammatory lesions.

2. In cases of carcinoma of the cervix, periodic roentgenographic study of the long bones should be done.

3. While distant metastases from carcinoma of the cervix uteri are rare, one should consider the possibility when the patient exhibits symptoms of tumor growth elsewhere in the body.

BIBLIOGRAPHY

(1) Ford, Frances A.: Distant Metastasis in Carcinoma of the Cervix of the Uterus. Minnesota Med., July, 1930, XIII, 489-494.

(2) Jeaneney, G.: Osseous Metastasis in Untreated Cancer of the Cervix. Bull. et mém. Soc. nat. de Chir., Paris, November, 1926, LII, 1029-1031.

(3) Kaplan, Ira I.: Practical Radiation Therapy. W. B. Saunders Company, Philadelphia, 1931.

(4) Monad, R. C.: Osseous and Visceral Metastasis in Non-irradiated Cancer of the Cervix. Bull. et mém. Soc. nat. de Chir., Paris, 1927, LIII, 712-716.

PACK FOR USE IN APPLYING RADIUM TO THE SOFT PALATE

By JOHN S. WILSON, M.D.,
Mack Wilson Hospital, Monticello, Arkansas

Recently we were called upon to treat an elderly man who presented extensive carcinoma of the under surface of the posterior part of the soft palate. The lesion had apparently extended well into the tissues of the palate and our only hope was to give the lesion a heavy dose of well filtered radium. Attempts had been made to administer radium by having the patient hold a pack on a tongue depressor, but he would not, or could not, keep it in place.

Applications were made to the upper surface of the soft palate through two heavy catheters, each carrying 50 mg. of radium, which were passed back through the nares until they emerged in the pharynx. Filtration was through monel metal needles, which contained the radium, filtered through 1 mm. brass, and the catheters, which were 2 mm. thick. This application gave us the dosage we felt the lesions of the upper surface should have.

The next and greater problem was to bring radium in contact with the lesion on the under surface of the palate and to keep it there sufficiently long to deliver the necessary dose. After many attempts, we improvised the little device shown in Figure 1.

The dental modeling compound of which it was made was shaped to fit the lesion, be-

ing built around a small copper filter pan in which the radium was later placed. It was molded to extend backwards far enough to curve up in the pharynx around the soft palate, and this curved part was split to accommodate the posterior part of the nasal septum, and the curved ends perforated with hot wire to make holes for cords, as shown in the illustration. The radium was loaded in the pan filter, covered with a rubber filter, and applied to the lesion by passing threaded catheters through each nostril, the threads being drawn forward through the mouth and attached to each of the cords of the radium pack. Application was made by pulling the cords forward through the nares until the pack was fitted snugly in place. The pack was slipped over the fingers of the operator while the cords were being drawn taut by an assistant. When the cords were taut, it was seen that the appliance hugged well the posterior extremity of the soft palate, and, as they were tightened, they drew upward the posterior surface of the palate, bringing the affected tissues in direct contact with the radium pack. It was an easy matter to leave this pack in place until the desired dosage in milligram-hours was delivered. The cords were tied behind the patient's head, and, while this may be an objection to the pack, there is no possible chance for it to slip or for the patient to move it after it is in place.

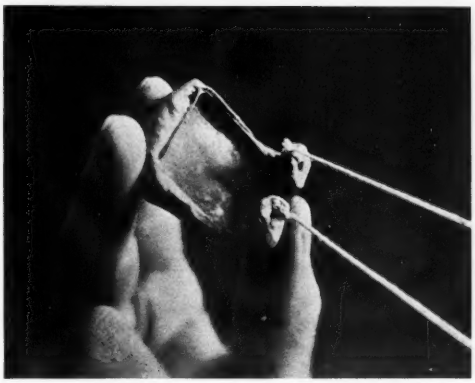

Fig. 1. Radium pack for application to the under surface of the posterior part of the soft palate.

Since the patient made no complaint of the presence of the pack, we feel that this appliance is not uncomfortable to wear.

EDITORIAL

LEON J. MENVILLE, M.D. . . . *Editor*
BUNDY ALLEN, M.D. . . *Associate Editor*

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THE TREATMENT OF TOXIC GOITER

Because of the prevalence of toxic goiter in this country, and also because of the divergent opinions as to the best and safest method in treating this disease, a symposium appertaining to this subject was held at the last meeting of the Radiological Society of North America.

The purpose of such a symposium is primarily educational. It offers an opportunity to present the most modern advance made in the treatment of a certain disease by some particular method or methods; also—which is of importance—it correlates the results obtained by physicians of varying experience in their own specialty, and not by a few outstanding physicians with large experience, connected with some renowned medical center.

We are presenting to our readers in this issue of RADIOLOGY a symposium on the treatment of toxic goiter by radiation therapy, surgery, and internal medicine. Those physicians participating are well known to the members of their own specialties, and have acquired experience and knowledge in the treatment of this disease. For this reason, this symposium should be representative of the present-day results obtained in the treatment of toxic goiter by the methods named.

For years, the principal forms of treatment used in toxic goiter were medical and surgical. Good results were being reported by surgeons. The percentage of cures was most gratifying, although the death rate was high. Improved surgical technic and greater experience in goiter surgery were the causes of a marked reduction in the mortality rate. In fact, to-day, in a few large surgical centers, where expert goiter surgeons operate, the mortality is less than 2 per cent. However, we must appreciate that this low mortality is not representative of that of the general surgeon. It is said that at present the surgical mortality following goiter operation by the general surgeon is about 10 per cent. This high mortality has given the medical profession much concern. It was hoped that some other form of treatment could be used in conjunction with surgery, or alone, which would produce a high percentage of cures with a negligible mortality. Radiation therapy is now ideally fulfilling this hope, and the results obtained by its use in carefully selected cases are far beyond the highest expectations of the medical profession.

There are several reasons why such excellent results are being obtained. One is that in treating the thyroid gland the thymus gland is also irradiated. It has been known for some time that certain changes occur in the thymus gland of patients suffering with thyrotoxicosis. Experiments have shown that after thymectomy in animals the thyroid gland tends to become hyperplastic as in Graves' disease, and likewise following thyroidectomy the thymus becomes hyperplastic. Many outstanding investigators have been emphatic in their belief that there exists a relation between hyperplasia of the thymus and thyrotoxi-

cosis, notable among whom are Crotti, Virchow, Gluck, Wiens, Wever, Kaufmann, Rossle, Hart, Halsted, and others. Another reason why radiation therapy has been uniformly successful in the treatment of thyrotoxicosis is the accuracy with which it can be administered. Ingenious scientific instruments have been devised, the result of years of scientific investigation and experimentation, which accurately measure the quantity and quality of the dose prescribed by the radiologist for his patient. A unit of measurement has been accepted internationally, known as the r unit, which is understood alike in all countries. In this manner, the language of the radiologists throughout the world is the same. A competent radiologist can duplicate with little difficulty any technic in radiation therapy anywhere. The bureaus of standards of most countries are prepared to calibrate such instruments in the r unit, so that when it is said a patient has been given 300 r units, it is known definitely the quantity of radiation received by the patient. In other words, this form of therapy is standardized and accounts for the uniform results obtained by radiologists in the treatment of toxic goiter.

In a statistical study of the results obtained in the treatment of toxic goiter by means of radiation therapy, by radiologists of varying experience in goiter therapy throughout this country, 10,541 cases have been treated with a favorable percentage of cures and a low percentage of failures. Of this group, operation had previously been done upon 980. No doubt, many of these cases had been operated on by surgeons unskillful in goiter surgery. It is unfortunate that this must happen, and that it will perhaps continue for some time, but not all surgeons have attained to a uniformly high degree of skill. Others were operated on by skillful and experienced surgeons. The failures may be accounted for on the basis of an accompanying thymic involvement, as many of these operative failures are cured by radiation therapy. In this regard, Crotti states that he routinely explores the upper mediastinum following thyroidectomy, and removes the thymus whenever it is found. It is his opinion that not only are the remote results of operation better, but that the operative course is more satisfactory.

Certain criticisms have been made against reporting goiter cases as improved. It is the belief of some that these cases, because they are not cured, must be classified as failures. We heartily agree with such criticisms when applied to surgical statistics, as the surgical and radiologic treatments are so different. In the instance of surgery, either the operation is a success or a failure; either too little or too much of the gland has been removed. Nevertheless, in radiation therapy, patients may receive a few treatments which improve their condition to such an extent that they believe themselves cured and desert before the treatment is completed. Others are advised by the referring physician to discontinue treatment, as they are considered by him as cured. In such instances they were markedly improved but not cured. Then again, patients after receiving one or two treatments, finding that they have not been cured, may fail to return. Most often, however, patients being treated by radiation therapy fall into a surgical atmosphere of persuasion, which naturally results in an operation. Many such cases were already markedly improved at the time of operation. A large number of these cases would have resulted in cures, and others, perhaps, in failures had they persisted with their treatments. It can be said in all fairness that at least one-half, or perhaps more, of the markedly improved patients, had they continued their treatment, would have been classified as cured and the others as failures. We can agree with

the critics that a given patient with toxic goiter, who abides by all the directions of the radiologist and receives the required number of treatments which would ordinarily constitute a cure, and is still only benefited, should be classified as a failure.

Radiation therapy in the treatment of toxic goiter has been the means of preventing a most distressing post-operative complication, namely, psychosis. This not infrequent complication is one to which a large number of patients suffering with exophthalmic goiter are susceptible. Its importance is emphasized by a prominent American goiter surgeon who says, "The incidence of post-operative psychosis is rather higher in thyroid surgery than in operative work in other regions of the body, due to the peculiar mental state of the toxic patient. Some physicians hold that individuals who develop exophthalmic goiter are mentally predisposed to the condition."

It would be unfair to say that surgery does not produce splendid results in the treatment of toxic goiter when performed by a skillful and experienced surgeon. Nor can there be a denial of the fact that there are too many failures and deaths as a result of operation by the general surgeon, who is skillful in other fields of surgery but lacks proper experience. Certain toxic goiters are best treated by surgery and such cases should be referred to surgeons by roentgenologists; on the other hand, cases in which radiation therapy is indicated should be referred to radiologists. "Render unto Cæsar the things that are Cæsar's."

COMMUNICATIONS

AMERICAN COLLEGE OF PHYSICIANS TO AWARD PRIZE TO O. T. AVERY, M.D.

The American College of Physicians recently selected O. T. Avery, M.D., of the Hospital of the Rockefeller Institute of New York City, as the recipient of the John Phillips Memorial Prize for 1932.

This prize, an annual award by the College in the sum of fifteen hundred dollars, is given to perpetuate in the College the memory of Dr. John Phillips, of Cleveland, a man of outstanding accomplishments as investigator, teacher, and physician, for many years a member of the Board of Regents of the American College of Physicians, who gave his life in saving others on the occasion of the Cleveland Clinic disaster on May 15, 1929.

The Committee on the John Phillips Memorial Prize, through its Chairman, James H. Means, M.D., of Boston, recommends the award, "To Dr. O. T. Avery for the series of studies upon the *Pneumococcus,* in which he has played a leading rôle, beginning with the discovery of the type-specific soluble capsular polysaccharides and culminating in the discovery of a bacterium producing an enzyme which splits the polysaccharides of Type 3 Pneumococcus *in vitro,* thus rendering it susceptible to phagocytosis and thereby protecting the animals infected with it."

The Sixteenth Annual Clinical Session of the College will be held in San Francisco during the week of April 4, 1932. Dr. Avery will deliver an address, "The Rôle of Specific Carbohydrates in Pneumococcus Infection and Immunity," at the Convocation on Wednesday evening, April 6. At the conclusion of Dr. Avery's address, the prize will be presented to him by S. Marx White, M.D., of Minneapolis, President of the College.

The distinction of this award is enhanced by the fact that, although it was available the previous year, it was not possible to decide on a suitable recipient. This is, therefore, the first award made. It is the hope of the officers and members of the College that this annual prize in memory of a distinguished colleague may, by recognizing merit, be a

continuing stimulus to investigators in those subjects having a direct bearing on the advancement of clinical science.

MINNESOTA RADIOLOGICAL SOCIETY

The winter meeting of the Minnesota Radiological Society was held at the University Hospital in Minneapolis on Saturday, February 13, 1932. The following program was presented:

CLINICAL-PATHOLOGICAL-RADIOLOGICAL CONFERENCE

Conducted by W. A. O'BRIEN, M.D.

Assisted by B. PEARSON, M.D., O. RANDALL, M.D., and R. KOUCKY, M.D.

1. Ewing's Sarcoma of Bone
   Discussion by W. Cole, M.D., and C. Hansen, M.D.
2. Multiple Myeloma, with Intestinal Obstruction
   Discussion by O. H. Wangensteen, M.D.
3. Carcinoma of Breast, with Multiple Metastases
   Discussion by K. Stenstrom, Ph.D., O. Campbell, M.D., and L. G. Rigler, M.D.
4. Carcinoma of Antrum, with Peripheral Metastases
   Discussion by W. Peyton, M.D., and K. Stenstrom, Ph.D.

Relative Value of Stereoscopic and Single Films in the Routine Examination of the Chest
Frederick B. Exner, M.D.

Studies on the Routine Examination of the Chest in Students
Harold Diehl, M.D.

Anomalous Lobes of the Lungs
L. G. Ericksen, M.D.

Observations on Intra-pleural Pressure in Massive Pulmonary Atelectasis
Rudolph Koucky, M.D.

Radiation Therapy of Neuritis
John J. Eneboe, M.D.

Fractures of the Sesamoids
Jacob Sagel, M.D.

Methods of Radiation Therapy of Carcinoma of the Esophagus
C. O. Hansen, M.D.

Intraperitoneal Herniæ: Preliminary Report
Frederick Exner, M.D.

The Use of Thorotrast in Roentgen Diagnosis: Preliminary Report
L. G. Ericksen, M.D.

ADDRESSES

The Recent Literature on the Classification and Treatment of Bone Tumors
W. A. O'Brien, M.D., Professor of Pathology, University of Minnesota

Cholecystographic Studies on the Emptying of the Human Gall Bladder
E. S. Boyden, M.D., Professor of Anatomy, University of Minnesota

The next meeting of the Minnesota Radiological Society will be held in St. Paul, May 23, 1932.

INDIANA ROENTGEN SOCIETY

The Indiana Roentgen Society held its fifth annual meeting in Indianapolis on the 22d of February. H. P. Doub, M.D., of Detroit, was the speaker.

The following officers were elected: *President-elect,* R. L. Lochry, M.D., of Indianapolis; *Vice-president,* H. W. Sigmond, M.D., of Crawfordsville; *Secretary* and *Treasurer,* J. N. Collins, M.D., of Indianapolis.

MEDICO-LEGAL NOTE

If members of the Radiological Society who have been—or are in the fear of being

—harassed into answering hypothetical questions while on the witness stand as ordinary witnesses will send me a stamped addressed envelope, I will be glad to send them some really desirable and illuminating information.

This offer is strictly limited to members of the Society, and then only *"Januis clausis."*

I. S. TROSTLER, M.D.

QUESTIONNAIRE FOR COMMITTEE ON RADIOLOGY, CALIFORNIA MEDICAL ASSOCIATION CANCER COMMISSION

The following questionnaire is being submitted to the radiological members of the California Medical Association Cancer Commission. Since radiology is playing a not inconsiderable part in the solution of the cancer question it may not be amiss to suggest to the readers of RADIOLOGY, everywhere, to send their replies to this inquiry to William E. Costolow, M.D., of Los Angeles. It is far too valuable a study to be confined to the members of one State association. Besides, it suggests itself as an interesting opportunity for a man to take measure of his methods and record his trials and successes.

GENERAL

1. Name minimum requirements for equipment in radiation therapy for malignancies:
   (a) Roentgen ray in superficial malignancies—in deep malignancies.
   (b) Radium in superficial malignancies —in deep malignancies.
2. What is your routine low voltage technic in superficial malignancies as to:
   Voltage,
   Filtration,
   Skin distance,
   Total skin erythemas applied.
3. What is your routine high voltage technic in more deeply situated malignancies as to:
   Voltage,
   Filtration,
   Skin distance,
   Total skin erythemas applied.
4. Do you use saturation methods (as outlined by Pfahler) or some other method in maintaining dosage in tumors over a period of time?
5. In high voltage technic for deeply situated tumors, do you measure your patient, plotting the tumor by cross-section anatomical charts (as Weatherwax technic) and compute the percentage of skin dose which the tumor receives?
6. Do you measure all your roentgen-ray dosages in r units by ionization methods?

SKIN

Keratotic Lesions

1. Is the Grenz ray sufficient?
2. Is X-ray alone the method of choice?
3. Should radium be used?
4. Are electrosurgical methods preferable?

Moles

1. In what types is radiation indicated?
2. How should melanotic moles be treated?
3. Have you seen any five-year cures in melanotic carcinoma?

Angiomas

1. Is X-ray indicated? If so, in what types?
2. Do you consider radium treatment the method of choice in all cases?
3. Should Beta rays of radium be utilized by using light filtration of radium, or should heavy filter (*e.g.*, 1 mm. platinum) be used?

4. In large cavernous types is heavy filtration with distance preferable?
5. Should dosage be applied slowly over long periods of time, or are large initial doses as desirable?

Squamous-cell Carcinoma of Skin

1. Do you use unfiltered X-ray in these lesions?
2. Do you use filtered radium exclusively?
3. Do you regard the Regaud type of technic preferable in these lesions?
4. What percentage do you regard as curable by radiation?
5. Do you consider radium preferable to roentgen ray in these lesions?

Basal-cell Carcinoma of Skin

1. Do you believe it justifiable to treat these lesions with roentgen ray alone? With radium alone?
2. Have you had experience in treating these lesions with radium, giving large doses by using small amounts of radium heavily filtered, over a long period of time (as Regaud method)? If so, have not your results from this method been as good as published surgical results?
3. In large infected lesions (either squamous or basal cell) would you advise immediate electrosurgical removal? Would you follow this by post-operative radiation or would you allow the area to heal and then treat recurrences with radiation if they appeared?

INTRA-ORAL MALIGNANCIES

Lip

1. Do you believe practically all local malignancies on the lip are curable by radiation?
2. Do you believe radium preferable to X-ray for the primary lesions on the lip?
3. Do you use small amounts of heavily filtered radium applied over long periods of time in lip lesions?
4. Do you apply radiation to neck gland areas routinely in all lip malignancies? If so, do you produce a single erythema or use the saturation method?
5. Do you use gold implants alone in neck nodes or do you believe a combination of implantation and surgery is better?

Floor of Mouth, Cheeks, and Tongue

1. In these lesions are gold radon implants or heavily filtered (1 to 2 mm. of platinum) surface applications preferable?
2. Do you consider radium alone superior to electrocoagulation in intra-oral lesions?
3. Would you advise a combination of these methods?
4. Do you take biopsy before instituting radiotherapy?
5. Is your radiotherapy influenced by the histological picture of the primary tumor? In other words, does the type of your treatment depend upon the pathologic findings or are all types treated with the same set-up? This refers to radiosensitivity based on the histological picture.

Pharyngeal and Tonsillar Malignancies

1. Do you precede the local application of radium to these lesions by external high voltage X-ray to sides of neck?
2. Method of treatment of local lesions—gold seeds or heavily filtered surface packs?

LARYNGEAL MALIGNANCIES

Intrinsic Malignancies

1. Is radiation justifiable here or should total laryngectomy be done?

Extrinsic Malignancies

1. Do you believe radiation the preferable method of treatment in these lesions?
2. Have you seen distinct benefit from radiation in these cases? Any cures?
3. Have you used the Coutard technic in these cases (heavy filter approximately 2 mm. Cu, moderate doses daily over long period of time, giving large total dosage—6,000 to 8,000 r)?

CHEST

1. Have you seen definite five-year cures from radiation in primary carcinoma of the lung?
2. Have you seen a number of definite palliative results from radiation in primary carcinoma of the lung? Approximately how many?
3. Were all cases treated by external high voltage X-ray or did some have radium applied directly through the bronchus?

BRAIN, SPINAL CORD

1. Have you seen definite palliative results from radiation treatment of brain and spinal cord tumors?
2. In what type of tumors?
3. What percentage of cases showed improvement?
4. Any definite five-year cures?
5. Was high voltage X-ray therapy used exclusively, or radium?

GASTRO-INTESTINAL

Esophagus and Stomach and Intestines

1. Any definite palliative results from radiation? Approximately how many? What were the palliative effects? Relief of pain or retardation of growth?
2. Radium used alone or combined with X-ray?
3. Any five-year cures?

RECTAL

1. Do you advise preliminary colostomy before radiation?
2. What type of radiation:
   (a) Gold seeds
   (b) Surface application of heavily filtered radium
   (c) High voltage X-ray therapy, or
   (d) A combination of these technics?
3. Do you precede the local application of radium with high voltage X-ray therapy?
4. What percentage of palliation does radiation alone give?
5. Does the palliation consist of—
   (a) Prolongation of life,
   (b) Lessening of bleeding,
   (c) Partially destroying and retarding growth,
   (d) Relief of pain?
6. Any five-year cures by radiation alone?
7. Number and percentage of these cures, if possible?
8. From experience, do you believe preoperative external radiation, by means of high voltage X-ray, produces enough destruction of rectal carcinoma, as evidenced by palpable shrinkage of the growth, to warrant its adoption in all operable cases? Would this improvement from the external radiation be sufficient to offset the delay in operation? How soon after the radiation course would you advise operation?

BONE TUMORS

1. Have you seen palliative or curative results in the following bone tumors from radiation?
   (a) Giant-cell tumors,
   (b) Osteogenic sarcoma,
   (c) Osteochondroma,
   (d) Osteitis fibrosa cystica,
   (e) Ewing's tumor,
   (f) Metastatic bone growths,

(g) Any other types.

2. Number and percentage of palliative improvements?
3. Number and percentage of five-year cures?
4. Would you always advise pre-operative radiation in all bone tumors in case operation is to be performed?
5. How long a time interval between radiation and operation would you advise?
6. In treating bone tumors by high voltage X-ray, have you used heavy filtration (1½ to 2 mm. Cu), applying moderate dosage over a long period of time by some type of saturation method?

LYMPHOGRANULOMAS (HODGKIN'S, LEUKEMIAS)

1. Have you used heavily filtered radium packs in these cases, treating multiple areas in a short period of time?
2. Do you use small doses of low voltage radiation therapy in these cases, followed by high voltage later when the cases seem to be becoming radio-resistant?
3. Have any of your cases in this group failed to show palliation following radiation?
4. Have any cases of acute leukemia shown temporary improvement or palliation?
5. Do you believe radiation definitely prolongs life in Hodgkin's disease? In leukemia?
6. Approximately what prolongation of life have your cases shown over average figures given in the literature?

GENITO-URINARY—MALE AND FEMALE

Testicular Tumors

1. Do you advise pre-operative radiation to the primary lesion followed by complete removal?
2. How long an interval between completion of radiation and radical removal?
3. Do you believe, from your experience, that radiation is superior to any operative interference on the abdominal lymph gland metastasis?
4. Have you seen five-year cures following radiation of the abdominal lymph gland metastasis?
5. Approximately how many?

Kidney Tumors

1. Have you seen any five-year cures from radiation alone in kidney tumors?
2. Would you advise pre-operative radiation of kidney tumors? Post-operative radiation?
3. In inoperable kidney tumors have you observed appreciable palliative effects from radiation, as—

   Lessening of pain?
   Lessening of hemorrhage?
   Diminution of size of growth?

Bladder Tumors

1. From experience, would you advise pre-operative radiation of bladder tumors by means of high voltage X-ray?
2. Do you consider electrocoagulation accompanied by implantation of gold radon seeds, followed by high voltage X-ray therapy, as the best technic in treating bladder malignancies?
3. Could you suggest another more desirable technic?
4. Have you seen five-year cures from radiation treatment alone in bladder tumor cases? Approximate number?
5. Have you seen five-year cures of bladder tumors from a combination of surgery and radiation? Approximate number?

Prostatic Malignancies

1. Have you seen five-year cures of carcinoma of prostate from radiation treatment alone?
2. Do you consider interstitial application of radium to prostate through perineum (by means of steel radium element needles or gold seeds through needles) of distinctive palliative value in malignancies of the prostate?
3. Do you consider high voltage X-ray to be of definite palliative value in inoperable carcinoma of prostate? In what percentage of cases?
4. In recurrent post-operative carcinoma of the prostate?

MALIGNANCIES, FEMALE ORGANS

Vulval or Vaginal Malignancies

1. Would you advise surgical or electrosurgical removal of these lesions, followed by radium and X-ray treatment?
2. Would you advise radium locally to these lesions (surface application or gold seeds) accompanied later by X-ray therapy over field and glandular areas?
3. Have you seen cases recurrent after operation cleared up, either temporarily or for a five-year period, by radiation methods?

Ovarian Malignancies

1. Is surgical removal of the primary tumor followed by high voltage X-ray therapy the proper procedure?
2. Do you believe attempted removal of metastatic masses logical?
3. Have you seen definite palliative results in treatment of metastatic ovarian carcinoma with high voltage X-ray? Approximate number?
4. Have you seen any five-year cures in the metastatic group just mentioned?

Uterine Malignancies

1. Do you believe all cases of carcinoma of cervix should be treated by radiation? Even small involvements limited entirely to cervix?
2. Do you advise high voltage X-ray treatment previous to local radium applications to cervix?
3. Do you use a more or less standardized method of application of radium (as Regaud or Stockholm method) or do you have a different technic of your own?
4. If you use your own technic, briefly describe.
5. Give average dosage of radium and X-ray—average number of milligram-hours used?
   Do you follow a saturation method of high voltage X-ray with measurement of patient and computation of pelvic dosage delivered?
6. Do you believe individualization of cases as regards extent of the disease when computing dosage to be given is an important factor in improving end-results?
7. Should X-ray therapy always be used in conjunction with local radium applications to the cervix?
8. Should cases of carcinoma of fundus (where growth is apparently entirely confined to the fundus) always be treated by total hysterectomy?
9. Have you used radium pre-operatively in these cases? How long an interval between radiation and operation?
10. Have you seen carcinoma of fundus cured by radiation alone?
11. Would you advise the use of high voltage X-ray in conjunction with radium in all cases of carcinoma of fundus?
12. Should advanced uterine cases with extensive pelvic gland involvement be treated with small amounts of radiation

for the palliative effect alone, or should an attempt be made to give full dosage?

13. What is the average amount of radium (describe filtration) you use intra-uterine in carcinoma of fundus?

THYROID MALIGNANCIES

1. Have you used interstitial radium applications in any case of thyroid malignancy?
2. Do you use high voltage X-ray alone or combined with distance radium packs?
3. Have you used a high voltage technic in these cases similar to the Coutard technic?
4. Have you seen five-year cures in thyroid malignancies? Approximate number?
5. What percentage of cases treated have shown definite palliative results? (Diminution of size of growth, relief of pain or pressure symptoms.)

WITH REFERENCE TO BREAST CANCER

1. Is it ever justifiable to depend entirely upon radium and X-ray therapy in operable cases?
2. In your opinion, does pre-operative radiation increase the number of five-year cures?
3. Do you select cases or give pre-operative radiation for every breast lump before exploration?

WITH REFERENCE TO RADIATION TECHNIC

(A) Of Pre-operative Radiation

1. Do you use low voltage (120 to 140 K.V., 4 to 6 mm. aluminum filter, 25 to 30 cm. skin distance) or
2. High voltage (160 to 200 K.V., 0.5 to 2 mm. copper filter, 50 to 80 cm. skin distance) or
3. Radium interstitially in heavily filtered, small amounts of element or emanation; or heavily filtered (equivalent to 2 mm. platinum) radium packs at a distance of from 3 to 6 cm.?
4. Are doses given daily in small amounts over a period of time (as in Regaud and Coutard methods), or are they given in the space of a few days?
5. How long an interval do you advise between pre-operative radiation and operation?

(B) Of Post-operative Radiation

1. Do you use post-operative radiation routinely or only where known cancer is left?
2. Do you believe from your experience that post-operative radiation should always be used routinely?
3. Do you prefer low voltage technic (as already described) or the low voltage technic over the breast area, with high voltage technic to axillary and supraclavicular areas?
4. Do you repeat your X-ray treatment cycle to the breast and gland areas in a few months, or do you wait until there is evidence of recurrence?
5. Do you consider the use of radium applied directly to nodular recurrences preferable to X-ray over the entire operative field? Is the radium used in the form of needles plunged around the nodule?
6. Has the combination of the two methods mentioned above proved more efficacious in your hands than either method singly?
7. From experience, do you believe recurrent nodules in field of operation should always be treated by radiation instead of surgery?
8. Have you seen a considerable number of cases with post-operative recurrences which have cleared up following radiation treatment, and remained so for a

five-year period? (Give percentage, if possible.)

WILLIAM E. COSTOLOW, M.D., *Chairman*
1407 S. Hope St., Los Angeles
R. G. TAYLOR, M.D., *Secretary*
Radiology Committee
C. M. A. Cancer Commission
January 9, 1932

RADIUM FOR SALE

The radium described below was the property of Henry A. Chapin, M.D., of Jacksonville, Illinois, whose death occurred last Winter. Mrs. Chapin is desirous of disposing of the radium, and the officers of the Society are glad to offer their assistance by publishing this notice.

B. S. No. 4518, a non-corrosive alloy needle 27.6 mm. long and 1.75 mm. external diameter, 12.43 milligrams of radium. B. S. No. 4515, a non-corrosive alloy needle 26.9 mm. long and 1.76 mm. external diameter, 12.47 milligrams of radium. These needles were purchased from Radium Chemical Company, Pittsburgh, in August, 1921. B. S. No. 4832, monel needle 29.13 mm. long and 1.48 mm. external diameter, 12.45 milligrams of radium. No. 4831, monel needle 28.6 mm. long and 1.50 mm. external diameter, 12.40 milligrams of radium, purchased from Radium Company of Colorado, Denver, Colorado, in September, 1921.

Address all communications to Mrs. Grace D. Chapin, Jacksonville, Illinois.

BOOK REVIEWS

DIE BEHANDLUNG DER KINDERKRANKHEITEN MIT ULTRAVIOLETT UND RÖNTGENSTRAHLEN. By PROF. DR. W. BIRK, Vorstand der Universitäts-Kinderklinik in Tübingen, and DR. L. SCHALL, Chefarzt der Kinderabteilung am Landeskrankenhaus Homburg-Saar. Volume XVII, Sonderbände zur Strahlentherapie. Second enlarged and revised edition of "Strahlenbehandlung bei Kinderkrankheiten," published in 1924. Published by Urban and Schwarzenberg, Berlin, 1932. Paper, 256 pages, and 45 illustrations. Price, 12 marks.

The applications of radiotherapy to the treatment of diseases in children have developed to such an extent since 1924 that the authors have felt constrained to expand and revise their text-book on "Radiotherapy in Pediatrics." This revision is so radical that, in truth, a new text has resulted. The book falls naturally into two parts: first, the applications of ultra-violet, and secondly, the uses of X-rays. Schall is largely responsible for the chapters on ultra-violet, and Birk for those on X-ray, but all sections have been amended where necessary by the experience of both men, so that a real joint-authorship results.

The physical aspects of both kinds of radiation are taken up in detail, apparatus is discussed briefly, dosimetry is considered from the special point of view of its peculiarities in regard to children, and then the treatment of various diseases is illustrated in detail and amplified by a wealth of clinical histories. Throughout the whole book there is a tone of conservatism.

The opinion of the authors is that there are really three groups into which the radiotherapy of children's diseases falls according to the best data available at present. There is the first group in which radiotherapy is the method of choice, and in which cure is practically certain. To it belong tuberculosis of the peritoneal cavity, tuberculosis of the mesenterial nodes, and peripheral lymph node tuberculosis. Thymic hyperplasia also falls into this group, but the authors are inclined to doubt the existence of this lesion as a frequent or important clinical entity. In the second group radiotherapy usually produces no lasting cures but is the best method of palliation for lymphogranuloma, the leukemias, and some other blood diseases. In the third group is a series of diseases in which the value of radiotherapy is debatable, such as bronchial asthma, hypertrophy of the tonsils, diseases of the cerebral nervous system, etc.

The book should be read by all radiotherapists, who will learn much which is new, interesting, and important in this specialized field, and merits serious consideration by pediatricians, to whom is presented much information of value, both in regard to indications for radiotherapy and the results to expect from it.

As is usual with the publishers, the make-up of the volume is first-class.

E. T. LEDDY, M.D.

WILHELM CONRAD RÖNTGEN AND THE HISTORY OF ROENTGEN RAYS (UND DIE GESCHICHTE DER RÖNTGENSTRAHLEN). By OTTO GLASSER, PH.D., Cleveland Clinic Foundation, Cleveland, Ohio. With personal recollections by MARGRET BOVERI, Berlin. Pages, 337, with 96 illustrations. Published by Julius Springer, Berlin, 1931. Price, 27 marks; bound, 29.60 marks.

Years ago I suggested to Glasser that the writing of a biography of Roentgen was a work for his hand, and now, as the spiritual father of the idea, I welcome this child into the world of literature. This book, "Wilhelm Conrad Röntgen und die Geschichte der Röntgenstrahlen," is the story of Roentgen's life and of the eventful year of 1896. It contains a contribution from the pen of Margret Boveri, daughter of Professor Theodore Boveri, a life-long and intimate friend of Roentgen's.

The book begins with the account of the discovery, as given by Roentgen to H. J. W. Dam (sent by "McClure's Magazine" to interview him), and published in April, 1896, in "McClure's Magazine."

The incident of the book and the key as related by T. S. Middleton, a student at the Würzburg University at the time Roentgen made his discovery, finds no credence in Glasser's estimation. Glasser discounts it completely. But why might it not have occurred? There is the episode of Archimedes rushing out of his bathtub crying, "Eureka!"; there is the story of Newton and the apple; of Einstein, to whom the pivotal idea of the relativity theory came in a dream when he had almost decided to abandon it. Perhaps the explanation of the key image on the photographic plates did lead him to search further. Who knows? Professor Goodspeed, of Philadelphia, had noted in 1890 strange images on photographic plates, exposed to Crookes' tubes, five years before Roentgen's discovery, and had left these mysterious markings unexplained, but Roentgen, as he assured MacKenzie Davidson, did not wonder, but investigated. Perhaps the incident did not occur. What do the Italians say, "Se non è vero, è ben trovato"?

Glasser gives in detail the story of Roentgen's life and of his scientific achievements. Margret Boveri then picks up the tale and tells of his youth, his university life, his reaction to war, politics, science, and art and the last sorrowful years of his life. There are many of Roentgen's letters which enable one to look into his mind and judge the motivating ideas of his life. He believed in truth and sought for it, in every phase of his experience, in his scientific work, and in his daily life. He believed in his fellowmen and tried to serve them. But how he hated bigotry and religious intolerance and what a contempt he had for unfounded scientific generalizations!

It is fashionable in the literary world, at the present time, to write biography, but biographies which are in reality fiction or, at any rate, belong to the rapidly increasing class of publications known as novelized biographies. The method in this form of literature is to omit all deeds or events in the subject's career not susceptible to emphasis, but to magnify everything that can be made sensational.

Here is a life, however, which needs no novelization to make it interesting. It has all the essential elements of drama. Here

is a modest, methodical, painstaking physicist living in the peace of the library and laboratory, leading the orderly regulated life of a teacher of physics in a small German university, who suddenly discovers a curious phenomenon, a phenomenon so strange and so startling as to be almost unbelievable, a phenomenon which proves to be of such tremendous import as to shake the world of physics to its very foundation. He announces the discovery, and an astonished world grasps at once the import of it and showers him with honors and approbation, yet he remains as before, a modest, retiring, simple, unassuming student of Nature, happy in the circle of his friends and family, desiring all for science and but little for himself. Then comes the war and its aftermath, engulfing him in its tragedy and making of him, in the end, a sad and lonely figure.

Glasser's description of the reaction of the daily press to the discovery is full and complete and contains an account of the discovery as reported in the scientific journals, and the description of the first magazine dealing with roentgenology, the "Archives of Skiagraphy," published in 1896. Then follow Roentgen's first two papers, the beginnings of fluoroscopy, the early application of X-rays in medicine, the early diagnostic X-ray literature, the first observations on the therapeutic use of the X-ray, the development of the X-ray tube and energizing apparatus, intensifying screens, the beginning revolutionary changes in the world of physics, the use of the X-ray in the arts, the discovery as viewed by the comic press, and letters from pioneer workers recounting their early experience with the newly discovered ray. The book closes with the third contribution of Roentgen in May, 1897, "Further Observations on the Characteristics of the X-ray."

Many interesting illustrations taken from early publications on the X-rays and numerous pictures of Roentgen and his family and friends add to the value of this work. It is apparent that Glasser does not like the bust the sculptor Hildebrand made of Roentgen, for he does not show a picture of it. His friend Boveri thought it admirable for he writes to Roentgen: "I find the likeness and expression wonderful and think that this bust belongs to Hildebrand's best work. One sees in it clearly a labor of love and joy. How marvelously the brow is modelled! The attitude of the head and the expression of the eyes are beyond criticism . . ."

I think this extraordinary work is the very epitome of spiritual grandeur and beauty. It is certainly superior to all the studied photographs of Roentgen extant, most of which are reproduced in the book.

The volume is filled to the brim with facts gathered through great industry and effort. It is an extraordinary piece of research work of its kind. Unfortunately, it lacks an index. Rather pedantic and sophomoric in its literary style, it is nevertheless written with great sincerity and a burning enthusiasm, which a worker in this field finds difficult to avoid, knowing the great import of the discovery and the revolutionary changes it has wrought.

From the extraordinarily complete data some one will some day write a fascinating story of the events which transpired in the world of physics in the year 1896, after the discovery which Roentgen made on that fateful Friday evening of November 8, 1895, and of which he said to Boveri a few days later, "I have discovered something interesting, but I do not yet know whether my observations are correct."

I. S. H.

LES DÉBUTS ET LES ARRÊTS DE LA TUBERCULOS PULMONAIRE. By LÉON BERNARD, Professeur de Clinique de la Tuberculose à la Faculté de Médecine de Paris, Membre de

l'Académie de Médecine. Published by Masson et Cie, Paris, 1931. Pages 266 and 71 plates. Price, 40 francs.

This is one of several works which constitute the library on phthisiology published under the editorship of the author himself. The book is an attempt to bring together and to analyze the extensive body of knowledge relating to pulmonary tuberculosis, which has accumulated during recent years as a result of numerous developments in roentgenology, bacteriology and serology, experimental and social medicine, surgery and chemotherapy. In no sense a treatise or text-book, it is, primarily, the expression of the personal studies and experience of the author, who, by reason of his position as a teacher, his extensive clinical experience, and his previous writings, is known as one of the leading authorities in the field. Throughout the work, one is impressed by breadth and soundness of judgment, and by the critical sense with which the clinical, pathologic, and roentgenologic factors are evaluated and correlated. The book is well printed and contains many half-tone reproductions of roentgenograms which are well selected to illustrate the features described.

The twelve chapters deal with present ideas on the development of pulmonary tuberculosis; the onset of primary infection at different ages; the onset of recurring tuberculosis in the intercleido-hilar, parahilar, basilar, parietal, and apical portions of the lungs; the correlation of roentgenologic images or signs of tuberculosis in the different localizations previously mentioned; the lobar variety of onset; onset by diffuse miliary extension; the so-called typhobacillar form of onset; the arrest of primary infection and of recurring infection, as well as a discussion of tuberculosis as it affects, or is affected by, marriage.

To any one interested in pulmonary tuberculosis, either from the clinical or roentgenologic standpoint, this work must be of decided interest and value.

PHYSICS AND ELECTRICITY (PHYSIK UND ELEKTRIZITÄTSLEHRE). By DR. ROBERT JAEGER, Regierungsrat bei der Physikal.-Techn. Reichsanstalt, Berlin. With an Introduction by Oberregierungs- und Obermedizinalrat DR. WALTER LUSTIG, Berlin. A handbook for the doctor and technician of laboratory technic and roentgenologic methods, edited by DR. WALTER LUSTIG. Volume V, 175 pages (paper volume), with 289 illustrations. Published by Fischer's Medizinische Buchhandlung, Leipzig, 1931. Price, 9.80 marks.

It is a very difficult task indeed to write a brief text-book on physics for readers who are not familiar with calculus, particularly with differential equations and integration. The author will find himself compelled either to sacrifice to a certain degree the accuracy aspired to by the full-fledged physicist or to write "over the heads" of his students. After reading the book of Jaeger I must confess that he has succeeded remarkably in satisfying both requirements. In 168 pages the fundamentals of mechanics, of solid bodies, liquids and gases, acoustics, heat, optics and electricity are outlined and illustrated by simple diagrams. Practical references in the various chapters as, for instance, to the mechanics of joints, the clinical thermometer, sphygmomanometer, the microscope, medical lamps, electrocardiogram, ionization instruments, and diathermy apparatus render the book most suitable to the novice in medicine or the apprentice in the X-ray and clinical laboratory. The last two chapters deal with practical problems in electricity which should be of interest to anyone working in an X-ray laboratory.

The author, who is a member of the staff of the German Bureau of Standards in Berlin, has presented us with a brief but concise book for the beginner in physics, which is recommended particularly to teachers of X-ray and laboratory courses as a helpful guide in arranging their class work.

GYNECOLOGICAL ROENTGENOLOGY. A roentgen atlas of the female generative organs, with special reference to uterosalpingography, an outline of gynecology in its relation to roentgenology, and a chapter on radium therapy. By JULIUS JARCHO, M.D.,

F.A.C.S., attending gynecologist and obstetrician, Sydenham Hospital, New York. Pages 650, illustrations 273, and 5 colored plates (cloth volume). Published by Paul B. Hoeber, New York, 1931. Price $20.00

This book is particularly interesting as the first attempt, in this country at least, to compile and co-ordinate all the work that has been done in gynecologic roentgenology. It is the more significant since the advent of uterosalpingography and its combination with pneumonography. The author has quite thoroughly gone over the literature, which is represented in an adequate bibliography. He presents a rather lengthy, although interesting, historical sketch of the entire field, presenting in detail —perhaps too much—the steps that were taken before the present stage of progress was reached. A few additional drawings or cuts would have demonstrated the older apparatus to more advantage than a lengthy and rather difficult description.

There is an excellent discussion of the Rubin test, both in the original and in the most recent modifications. The test is evaluated against the intra-uterine iodized oil instillation, both as to its demonstration of tubal patency or non-patency, and the determination of the point of obstruction when such is present. The author favors the newer procedure, citing examples of tubes impervious to gas and patent to iodized oil, and discusses the relative reliability of diagnosing a point of tubal stricture by reference of pain, as against actual visualization.

The technic of uterosalpingography is presented in some detail, with sketches of the necessary apparatus. Again, more drawings or cuts could be used to advantage. There is a reasonable conception of indications and contra-indications to this and the other procedures, with a special effort to allay the fears of ultraconservative operators. The book contains a very interesting and fairly complete series of uterosalpingographs, with their interpretations and also the clinical findings. This is the more valuable because of a well written chapter on the physiology of the uterus and tubes as brought out by iodized oil and serial examination. The combined method receives approbation but hardly adequate treatment. Very few illustrations of pathologic conditions, as exhibited by this method, are shown. The author discusses the method of Béclère, placing a lead wire about the limits of a palpable tumor before radiographic examination, to outline the tumor on the films. Besides the restriction of this method to tumors of considerable size, or convenient location, the element of possible faulty projection of the shadow of the wire relative to that of the intra-abdominal structures enters. The combined method (pneumoperitoneum plus iodized oil instillation) appears, by all odds, to be more simple, accurate, and graphic.

The therapeutic value of intra-uterine insufflation by gas and instillation of iodized oil is presented in detail, together with representative case studies. There is also a short discussion of radiation in gynecology.

The reviewer feels that in the section devoted to the description of roentgenographic technic, this could be handled to better advantage by a less verbose description and a few cuts to illustrate, rather than a description of the patient and the relation of the incident ray to the organ to be rayed, which, at best, is both obscure and faulty. The chapter on equipment might be revamped to advantage. However, the book is extremely interesting, well written and edited, and gives a good summary of the roentgen diagnosis of lesions of the female pelvis, with reasonable conclusions.

The reviewer, however, would like to call attention to the composition of the book which, at this day, should be taken into consideration, namely, the unusually large type, such as is used in grade school primers, and which is quite uncalled for, making the book at least half again as large as need be. Nowhere are there higher priced volumes than roentgen publications, and the price of this volume is no exception.

PRECIS DE PHYSIOTHERAPIE ET DE PETITE CHIRURGIE DERMATOLOGIQUES. By JEAN MEYER and JEAN SAIDMAN, with the collaboration of ROBERT GIRAUDEAU. Preface by H. GOUGEROT, Professor of Dermato-

syphilography at the Faculty of Medicine of Paris, Doctor at Saint Louis Hospital. Published by Gaston Doin & Cie, Paris, 1931. Pages 200; figures, 24. Price, 38 francs.

This book is an exhaustive treatise, but is intended to help general practitioners in dealing with certain skin affections and in knowing the forms of treatment best adapted to certain cases. Moreover, the book is not an evaluation of methods employed by other workers, but is strictly confined to a brief description of the methods employed by the authors themselves. Among the therapeutic agencies considered are high frequency currents, including surgical diathermy, ultra-violet irradiation in its different forms, infra-red rays, roentgen rays, radium, cryotherapy, and hot air. Much more attention is given to the use of high frequency currents and ultra-violet rays than to any other method. For instance, the general considerations on radium are covered in three pages. The section dealing with the general aspects of roentgen-ray treatment is somwhat more adequate. In connection with radiodermatitis, no mention is made of late lesions occurring from six months to three or more years after irradiation. The authors also fail to mention the fact that secondary infection plays such an important rôle in the slow healing of radiodermatitic ulcers. They seem to favor ultra-violet irradiation for keloids, although it is well known that roentgen rays or radium are more effective. The same is true of furuncle and other infections of the skin. As a general guide the book is useful, but with reference to certain conditions, such as those mentioned, the therapeutic recommendations can hardly be said to represent the soundest opinion. Also, the descriptions of the technic of treatment given in relation to many conditions are altogether too brief.

ROENTGEN STEREOSCOPY IN PULMONARY DISEASES (RÖNTGENSTEREOSKOPIE BEI LUNGENKRANKHEITEN). By DR. W. KREMER, Dirigierender Arzt an den Beelitzer Heilanstalten und Leiter des Tuberkulosekrankenhauses, and DR. W. LUEDKE, Assistenzarzt am Tuberkulosekrankenhaus der Beelitzer Heilanstalten. No. 40, Tuberkulose-Bibliothek, Beihefte zur Zeitschrift für Tuberkulose herausgegeben von Prof. Dr. Lydia Rabinowitsch. Paper-bound volume; 35 pages, with 23 illustrations, 8 of which are colored. Published by Johann Ambrosius Barth, Leipzig, 1931. Price, 3.75 marks.

Dr. Kremer and Dr. Luedke go to great pains and unusual lengths to establish the *rationale* of pulmonary stereoroentgenography. They show that stereoscopic procedure has advantages and disadvantages. Of the latter, they mention (1) the inability of many persons, especially physicians, to see stereoscopically; (2) the lack of artistic plasticity in stereoscopy because of the lack of colors, shades, air perspective, etc., and (3) the technical difficulties, especially the short exposure technic. As for the advantages, they mention the value of stereoscopy:

1. For diagnostic purposes in differentiation
   - *(a)* between intra- and extra-thoracic pathology, especially of gland shadows;
   - *(b)* of rib pathology (osteomas) and intrapleural pathology (cavities);
   - *(c)* between pleural and intrapleural processes (Cova's "tortoise-shell pleuritis," cavities, and annular shadows);
   - *(d)* of vascular and hilus shadows.
2. For use in operative intervention
   - *(a)* as to localization of foreign bodies;
   - *(b)* for Jacobaeus' operation;
   - *(c)* for localization of cavities for thoracoplasty;
   - *(d)* for abscess operations.

The remainder of the pamphlet is devoted to the evaluation of various types of apparatus and a discussion of the history and applicability of the anaglyphic process. There are eight illustrations of chest pathology and the accompanying anaglyphic duplicates, which are shown to support their contentions.

The first main point made by the authors —the necessity and value of pulmonary stereoroentgenography—is one which was recognized in this country long ago. The second

main point of their thesis—the necessity for short exposure technic—was established routinely in this country long since, and it is no longer mentioned. As for the various types of apparatus described, all of them are of purely local German manufacture, and none of them offers any noteworthy features for the roentgen laboratory which is provided with any standard American equipment.

The only real departure in the book is the use of the anaglyphic principle in pulmonary stereoroentgenography, and it is doubtful whether the value of the process the authors advocate is substantiated by the argument or the examples they show. The style is abstruse and complicated, and the article is not graced in its execution with any factors which would predispose the reader in favor of the procedure which the writers promulgate.

W. Walter Wasson, M.D.

Roentgen Diagnosis of the Viscera by Tables and Drawings (Röntgendiagnostik der erkrankungen innerer Organe in Tabellen und Skizzen). By Dr. Emmerich Markovits, Head of the Roentgen Laboratory of the State Asylum in Budapest, and collaborator of the Central Roentgen Institute of Allgemeines Krankenhaus in Vienna. With an Introduction by the late Hofrat Prof. Dr. Guido Holzknecht, Director of the Central Roentgen Institute of the Allgemeines Krankenhaus, Vienna. Second, revised edition, with 429 illustrations, and 224 pages. Published by Georg Thieme, Leipzig, 1931. Price, 17.50 marks.

This new edition of Markovits' work has included the findings of intravenous pyelography, the methods of bringing out the relief of the gastric and intestinal mucosa, discussion on polyposis, diverticula, and new material on cholecystography and hysterography.

The peculiar value of this work lies in the numerous tables of differential diagnostic points in regard to nearly every lesion of the respiratory, gastro-intestinal, biliary, urinary, and genital tracts. The numerous line drawings illustrate the various diagnostic points better, perhaps, than the more expensive half-tone reproductions of roentgenograms. These drawings are such as one might make on the blackboard to illustrate class lectures. This method of drawings and comparative tables permits one to cover the entire field of roentgenologic diagnostics of internal medicine within the covers of a relatively small volume. Familiarity with this work cannot fail to enhance very greatly the percentage of correct diagnoses in any roentgen laboratory. All radiologists, readers of German, will do well to acquire a copy of this valuable treatise.

James T. Case, M.D.

Roentgen Diagnosis and Therapy in Diseases of the Eye (Die Röntgendiagnostik und -therapie in der Augenheilkunde). Radiologische Praktika, Band 19. By Dr. Wolfgang Hoffmann, Chief Physician of the Ophthalmological Clinic, University of Königsberg i. Pr. Pages, 72, and illustrations, 20. Published by Georg Thieme, Leipzig, 1932. Price, 8.70 marks.

This is a small but very timely volume, for, in addition to the 24 pages devoted to roentgen diagnosis in diseases of the eye, the remainder of the 72 pages in this work is devoted to roentgen therapy, beginning with damage which may be suffered from the roentgen rays. These roentgen-ray damages to the eye are considered under two headings: First, those which may appear shortly after the irradiation; second, late-appearing damage, such as cataracts and glaucoma. There follows an appropriate chapter on protection of the eye during roentgen irradiation, and then a detailed consideration of the application of X-rays in the treatment of tuberculosis of the eyes and their surroundings; chronic inflammation of the eyeball other than tuberculosis; chronic inflammation of the lids, especially blepharitis, granulosis, and spring catarrh; acute inflammation; glaucoma and epiphora; tumors. Ten pages are devoted to the literature.

Of special interest, and as a timely warning, there is an excellent section devoted to cataracts and glaucoma as late roentgen damages.

The roentgen cataract has its form similar to that seen in the glassblowers' cataract. It may appear as early as four months, but more often it makes its development two to three years after the treatment. One case has been reported as late as eight years. The smallest recorded dose which has resulted in a cataract was 110 per cent of the skin erythema dose. However, patients who are suffering from skin diseases, such as lupus, eczema, and other similar lesions are especially sensitive, as well as patients who are poorly nourished. A larger total dosage of roentgen therapy can be received by the orbit without the production of cataract, provided the doses are partitioned. For instance, 1,200 roentgens given over four weeks are required to produce a typical roentgen cataract in experimental work on animals, whereas 1,000 roentgens will produce the same damage if given in one treatment. The main precaution to observe is that epilation must not occur.

JAMES T. CASE, M.D.

PULMONARY SYPHILIS IN ADULTS (DIE LUNGENSYPHILIS DES ERWACHSENEN). By DR. L. DÜNNER, ärtzlicher Direktor, DR. F. LEESER, Röntgenologe, and DR. H. BLUME, Assistenzarzt am städtischen Hospital Buch-West in Berlin. No. 41, Tuberkulose-Bibliothek, Beihefte zur Zeitschrift für Tuberkulose herausgegeben von Prof. Dr. Lydia Rabinowitsch. Paper-bound volume; 52 pages, with 37 illustrations. Published by Johann Ambrosius Barth, Leipzig, 1931. Price, 6 marks.

The monograph of fifty-two pages by Dr. Dünner, Dr. Leeser, and Dr. Blume on pulmonary syphilis is characterized by an intense caution. A careful and evidently exhaustive review of the literature as well as the study of cases in their own experience makes them highly circumspect in giving a positive diagnosis of lung syphilis. The book is divided into a number of sections or chapters, the titles of which show the encyclopedic approach followed in the presentation. Under the heading of "Generalizations concerning Syphilis," the authors mention the work of Rothschild, in which he claimed to have diagnosed syphilis in the secondary stage and even some cases during the incubation period. They feel that tertiary syphilis only is demonstrable. They stress the prevalence of confusion in the differential diagnosis of pulmonary syphilis and other chronic diseases. A statistical review of the number of cases proved at autopsy shows great divergence. They attribute this either to geographic discrepancies or to the inexperience of the examining pathologist. Skill in the pathologic diagnosis of lung syphilis would account for the findings of Rössle, who demonstrated twenty-five cases from autopsy material seen by him during his service in Jena. These were cases which had not been suspected clinically. After discussing history, symptomatology, diagnostic means, and pathology in general terms the authors indicate that the material which is to follow will prove that, after all, there are but two dependable diagnostic points; namely, the persistent failure to demonstrate tubercle bacilli in the sputum, and the localization of the lung process in the middle or lower lobes, especially on the right side. They add that a third point may be admissible also in certain types of cases; namely, the success of a specific cure in the treatment of true gummas.

The next chapter deals with "Diagnosis" in regard to *(a)* history and common symptoms, *(b)* physical findings, *(c)* sputum findings ("There is no specific sputum for syphilis"), *(d)* serological reactions for syphilis, *(e)* other syphilitic changes, and *(f)* roentgen findings—three types: (1) the chronic interstitial pneumonic form; (2) the rare isolated gummas, and (3) the miliary gummatous form. The conclusions from reviewing these phases of the situation are that the previously mentioned points are the only decisive ones for diagnosis although the roentgenogram is a necessary adjunct in all doubtful cases and as a means of following the progress of therapy.

The third main chapter heading is "Prognosis and Therapy." The authors say that they will speak in this article less of prognosis and therapy and more of symptoms and diagnosis. They advocate mild and harmless treatment which may be gradually fortified and increased. Their reason for this is the great possibility of a mistaken diagnosis, and

the consequent ill effects which would accrue to a diseased heart condition if strenuous antisyphilitic treatment were instituted at the beginning of the illness.

The fourth chapter deals with the "Pathological Anatomy." Dr. Dünner, Dr. Leeser, and Dr. Blume distinguish two types: (1) the interstitial pneumonic form, and (2) the gummatous. According to localization, they list three groups:

1. Gummatous changes with coarse radiating cicatrices, in the upper and lower lobes.
2. The interstitial form with finer cicatrices in the hilus region.
   (a) In the lower lobes.
   (b) Especially probable in the right middle and lower lobes.
3. Bronchiectasis on a syphilitic base, in the middle and lower lobes.

Also, they have compiled an excellent diagrammatic chart which portrays, in graphic and readily accessible form, the similar and dissimilar characteristic findings of pulmonary syphilis and tuberculosis.

After citing twelve cases, of which four were positive syphilis, four were probable syphilis, three were doubtful, and one was tuberculosis with a questionable syphilitic complication, the authors conclude with certain questions prompted by the critical analysis of these cases. They do not attempt to answer the questions, and the reader is left with the impression that they believe:

(1) That pulmonary syphilis *per se* is truly a rare disease.

(2) That the diagnostic methods at our disposal are valuable but not conclusive, because of the similarity between the case history, common symptoms, physical findings, sputum examination, and serological reaction for syphilis and other chronic pulmonary diseases.

(3) That there are but two factors which can be considered positive indicators of lung syphilis—*(a)* failure to demonstrate tubercle bacilli in repeated sputum examinations, *(b)* the localization of the process in the middle and lower lobes, especially of the right lung.

(4) That there is a third point which may be considered as confirmatory in the diagnosis of pulmonary syphilis, namely, the success of a specific cure in the treatment of true gummas.

(5) That even the careful consideration of the collected clinical and recorded findings and tests can lead only to a presumptive diagnosis.

(6) That the positive diagnosis must come from the examination of necropsy material by a pathologist experienced in discerning this particular disease.

(7) That tuberculosis and syphilis may exist simultaneously in different sections of the same pair of lungs.

On the whole, the authors seem to be constantly advising the utmost care and precision in the analysis and evaluation of diagnostic and therapeutic measures as well as persistent skepticism even in the face of what may seem to be an absolutely positive diagnosis of pulmonary syphilis. The style is direct and straightforward, and there is no equivocation in the statements of their opinions. The especially facile German in which it is written makes the original publication pleasant and enlightening to even the American reader possessed of but a textbook knowledge of the language.

W. Walter Wasson, M.D.

ABSTRACTS OF CURRENT LITERATURE

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THE APPENDIX

The Active Motility and the Emptying Mechanism of the Appendix Vermiformis. Ernst Schmidtlein Fortschr. a. d. Geb. d. Röntgenstr., August, 1931, XLIV, 141-162.

Observations on 21 appendices were made, from 7 to 9 hours *p.c.*, some under the influence of saline cathartics, all under the pharmacologic influences of 0.01 mg. pilocarpin, and 1 or 2 mg. of atropin at intervals of from 20 to 40 minutes. Conclusions were chiefly drawn from a comparison of from 4 to 8 exposures made at irregular intervals and some from occasional fluoroscopy. Experiments covered not more than 40 minutes. The author is aware of the possibility that the visible appendiceal shadow may not represent the entire length of the organ.

(*Abstractor's Note.*—It seems that the time of observation is much too short and that terms like "spasm at the appendico-cecal junction" should better be replaced by "contraction"; "stagnation" in the terminal portion also is easily misleading as it might give the impression of a pathologic phenomenon; the German term "Beutelung" ("pocketing" in English) might be less conspicuous.)

Motility of the organ is chiefly the result of changes in tone of the muscle coats. The proximal portion shows the expressions of changes in tone, peristalsis (at times reversed), and contractions. The distal portion is motorically inert and pockets contents regularly. Changes in muscle tone produce elongation and shortening, with apparent segmentation. Tortuosity and stagnation are of no functional pathognomonic significance.

HANS A. JARRE, M.D.

ARTHRITIS

Traumatic Disability of the Shoulder. George A. Ramsay. Canadian Med. Assn. Jour., November, 1931, XXV, 566-571.

Shoulder function may be seriously disabled by the common traumas of accident or by occupational over-use. That such cases need careful attention is seen in the records of insurance companies and workmen's compensation boards, where shoulder injuries are found to account for an average period of disability greater than other traumas. In one large group of cases of shoulder disability not due to fracture, one-eighth recovered fully in three months, while nearly one-half had partial permanent disability, and another eighth had permanent incapacity. The contribution of the X-ray examination was to the effect that one-half had no evident bone lesions, and that in cases in which such did exist they were found more frequently in the acromioclavicular joint than elsewhere. When osteoarthritis occurs in the shoulder following injury it is prone to become progressive, more so than in any other joint. If our previous concepts of management are insufficient, then we must face a situation that warrants our best efforts to arrive at a better rationale in treatment.

Shoulder disabilities would seem to fall within certain groups: (1) Frank trauma, with subsequent limitation of function; *(a)* burns causing a skin cicatrix; *(b)* fractures and dislocations. (2) Unseen traumas, with latent disability; *(a)* tendonitis; *(b)* neuritis; *(c)* cartilage injury, including recurrent dislocation; *(d)* adhesions; *(e)* periarthritis and arthritis.

Evident bone injury most frequently involves the upper third of the humerus, *i.e.*, the surgical and the anatomical neck, the tuberosities, and especially the facet of the supraspinatus on the greater tuberosity. In these conditions we should avoid such fixative appliances as will keep the arm applied to the body in the abducted internal rotated position. Further, the shoulder should not be neglected in the treatment of fractures of the clavicle, the lower humerus, the elbow, or the forearm. No splint should be applied in such a way as to cause a drag on the shoulder girdle. It should be remembered that the shoulder joint, with its shallow socket and large humeral head, is held in place largely by muscular action, the capsule playing a minor rôle in this respect. Any position or type of fixation that places any continued strain on these muscular supports will cause future loss of function and produce future discomfort.

Special attention is drawn to the avulsion of the facet of attachment of the supraspinatus muscle on the greater tuberosity, or to the rupture of the tendon of the muscle itself. So-called sprains of the shoulder joint are not due to a rupture of the capsule as in many other joints, for the capsule of the shoulder is so lax that it is almost impossible to rupture it. The injury is most often that to the supraspinatus muscle described above. The author gives detailed technic for the elicitation of this injury.

By far the larger group of cases of shoulder disability are those in which a definite anatomical lesion is not determinable, and in which the terms, synovitis, periarthritis, strain, or bursitis are very loosely applied. In general, we may say that there are injuries to the soft parts, with coincident synovitis, the acute lesion being usually sprain of muscle or tendon, while the more chronic lesion may be termed a periarthritis.

Muscle strain results in the formation of exudates, with subsequent adhesions about the tendinous extremity of that muscle. As this progresses it involves the capsule. The capsule, being the fusion

of the expanded tendons, soon becomes the site of a fibrosis. When the condition progresses so far that there is an exudate within the joint this gravitates to the anterior-inferior aspects of the capsule, where it becomes organized and forms adhesions. Unless these adhesions are broken up it is futile to spend time and money on physiotherapy.

Where arthritis exists, it is rational to consider the process infective, and to do a reasonable removal of foci. Later, when the joint is quiescent and showing some increased range of motion, adhesions may be broken up. Where lipping about the joint margins is excessive or the degeneration of osteo-arthritis is present, only fixation in a favorable angle can be accomplished.

L. J. CARTER, M.D.

Roentgenotherapy of Chronic Arthritis. H. O. Röhr. Strahlentherapie, Oct. 24, 1931, XLII, 425-436.

The author first discusses briefly the literature on roentgenotherapy in arthritis. He usually applies from 20 to 30 per cent H.E.D. (180 K.V., 0.5 mm. Cu + 1 mm. Al, 4 ma.) at a distance of 30 centimeters. Since it seems advisable to irradiate also the tissue surrounding the joint, large fields of 10 × 15 sq. cm. are used even for small joints. For large joints two fields are used in order to cover the surrounding tissue. Exposures are given at intervals of from three to four days.

A total of forty patients suffering from chronic arthritis were irradiated. Half of those had primary or secondary chronic arthritis; the other half, arthritis deformans, gout, and septic arthritis. In most cases irradiation was started after all other methods of treatment had failed. The most striking feature was a relief from pain following the first exposure. Swelling decreased and motility was improved. Then follows a brief discussion of the possible mechanism of the effect of roentgenotherapy in arthritis.

ERNST A. POHLE, M.D., Ph.D.

THE BLADDER

Reticulolymphosarcoma of Bladder. R. Dupont and V. Misrachi. Presse Méd., June 24, 1931, XXXIX, 937, 938. (Reprinted from "Cancer Review" by permission.)

In a woman, 32 years of age, who complained of repeated hematuria, pain in the right lower quadrant, and loss of weight, vaginal palpation revealed a right paramedial induration, the urine drawn off containing blood and pus. At operation a bi-lobed infiltrating tumor was found occupying a large part of the right lateral wall of the bladder. This was removed successfully by partial cystectomy. The recovery was uneventful, the patient being in good health a year later.

Leroux diagnosed the tumor histologically as a lymphosarcoma in which the stroma consisted of reticular cells. The authors add that since these sarcomas are radiosensitive, they would have used deep X-ray therapy, had it been possible to make a histologic diagnosis first, and that this will be resorted to should there be recurrence.

F. CAVERS, D.Sc.

The Roentgen Ray and Radium in the Diagnosis and Treatment of Carcinoma of the Bladder. G. E. Pfahler. Surg., Gynec. and Obst., November, 1931, LIII, 680-690.

The author believes additional information is obtained by combining a pneumocystographic study with the cystoscopic examination. In carcinoma of the bladder it is valuable in demonstrating the size, position, outline, and degree of infiltration.

The technic for pneumocystograms is to make an anterior and a posterior film of the bladder region before any air is injected. Any opaque calculus present will be shown, also any localized collection of gas in the rectum or colon which may hinder the interpretation of the subsequent pneumocystograms. Any residual urine should be withdrawn—the usual sterile methods being used—for a soft tumor surrounded by fluid may not be demonstrated. Either the film made anteriorly or posteriorly will show the tumor surrounded by air, even though occasionally one is unsuccessful in removing all the urine.

After the urine has been withdrawn, an atomizer bulb is attached to the catheter by using a tapering glass connecting rod; then by gentle compression with the thumb and index finger, air is pumped into the bladder until the patient complains of bladder distention or until one can feel the distention of the bladder by palpation or outline it by percussion. The catheter is then clamped with hemostatic forceps and both are strapped to the thigh with adhesive plaster. All of these procedures are performed as quickly as possible, with the patient on the Bucky diaphragm, and the tube and film in position, thus minimizing the delay and distress from bladder distention. If the injections are made slowly and due attention is paid to the patient's complaint of pressure, no harm results.

One or more 8 × 10 films are made posteriorly, directing the rays in line with the axis of the pelvis. Then one or more films are made anteriorly, the patient being carefully turned upon the abdomen and the rays directed obliquely, anteriorly, and upward. There should be some variation in the exposures. With the patient again in the supine position, the clamp is released and the air is quickly

expelled: compression may be used to aid in removing all of the air. The author has made several hundred such examinations with no damaging effects.

IRRADIATION TREATMENT

The author is not satisfied with the results of either surgical excision or irradiation, but points out that irradiation is used almost entirely in "inoperable" cases. He gives most complete tables showing the various methods of radiotherapy. Radium may be used alone in the form of capsules, needles, or seeds (glass or gold), or deep roentgenotherapy may be used alone, also in conjunction with electrocoagulation, before or after. The method of suprapubic cystotomy, electrocoagulation, and radium needles has been abandoned by the author, but that of electrocoagulation followed by highly filtered radium capsules packed into the bladder against the base of the tumor is favored.

Tables are also given of combined surgery and radiation treatment, electrocoagulation and radiation therapy, and of irradiation only.

D. S. CHILDS, M.D.

BONE (THERAPY)

Technic of Treatment of Fracture. Re-dressing without Removal of Plaster of Paris Bandage. Mauritz Parsson. Acta Orthopedica Scandinavica, 1931, 166-201.

In treatment of fractures of the long bones, a *dislocatio ad axin* not infrequently occurs, either immediately after application of the plaster of Paris bandage or a few weeks later. In such cases, instead of removal of the bandage, with re-dressing and application of a fresh bandage, the author advocates the following procedure: After roentgen examination in two perpendicular planes, generally the frontal and sagittal, the following measures are taken:

(1) Measurement on the roentgenograms of the angle between the axis of the lower fragment and the prolongation of the axis of the upper fragment (here termed the "angle of deviation").

(2) A horizontal cut is made by saw in the bandage at the level of the fracture, through the entire bandage, with preservation of a bridge from 4 to 5 cm. broad, on the side toward which the vertex of the angle between the fragments seems to point.

(3) Breaking of the plaster of Paris bandage with the enclosed member until the cut made by the saw is open at the desired angle, and then insertion into the cut of a plug of suitable size and shape.

(4) Roentgen control.

(5) Stiffening of the bandage with starch and plaster of Paris dressings.

In the fourteen cases recorded by the author the desired end was achieved and the angle of deviation was done away with, or nearly so. Five cases are reported in detail, with roentgenograms taken before and after the interference.

Further, a method, with figures and formulæ, is explained which renders it possible, exclusively by means of the two angles of deviation ascertained by roentgenograms in two perpendicular planes, to determine mathematically both the angle of deviation proper and the plane in which the angle of deviation lies in relation to the frontal and sagittal planes of the patient.

W. W. WHITELOCK, Ph.D.

BONE DISEASES (DIAGNOSIS)

A Clinical and Radiologic Study of a Case of Dyschondroplasia. Giorgina Giacomini. Riv. di radiol. e fisica med., December, 1931, IV, 206-222.

This case illustrates the following important radiologic points: Dyschondroplastic changes may be symmetrical and extend throughout most of the cartilaginous bones; in addition, there may exist cartilaginous exostoses and chondromatous outgrowths; these chondromatous changes may be encountered not only in the skeleton but also in any organ containing cartilage.

The case report has several excellent radiographs and is supplemented by an extensive bibliography.

E. T. LEDDY, M.D.

Deformities of the Femoral Head Following Nonsurgical Reduction of Congenital Dislocations of the Hip. Max Lange. Fortschr. a. d. Geb. d. Röntgenstr., August, 1931, XLIV, 227-231.

This paper is a reply to a publication by Freund, abstracted in a previous issue. The author contends that "late deformities of such hips are seen the more frequent the larger number of former old congenital hip luxations." Such late deformities never occur in femoral heads which originally were well formed and developed normally. Consequently, there is no danger of late deformities in cases in which an anatomic, perfect cure is obtained with reduction (concluded from study of cases from Munich, Dresden, Zwickau), covering a 10 to 15 year period.

One must differentiate between early and late deformities of such femoral heads, the former developing during the first year following the reduction, the latter occurring independently years later. Early deformities continue to undergo changes for many years, as these joints of lessened functional capacity will not tolerate normal use. They not infrequently terminate with arthritis deformans. The

author denies that true osteochondritic processes (Perthes) is a cause of such deformities, but admits that such disease may occur occasionally without relation to the former dislocation. He assumes, furthermore, that some of Freund's deformities may be explained by incongruities between the acetabula and the femoral heads, necessitating structural transformations. A reply from Freund is added to this paper, in which he maintains his stand.

HANS A. JARRE, M.D.

The Roentgenologic Diagnosis of Bone Tumors. Franz Polgár. Röntgenpraxis, Nov. 1, 1931, III, 963-972.

The roentgenologic examination of bone tumors, especially if done in serials, is more important than even a biopsy. The removal of a small piece of tissue from bone tumors is not always harmless, and histologic examination of such small specimens does not always decide between the benign or malignant type. The differentiation of these two on roentgenograms is often possible only if a series of films, taken at intervals, is studied.

Benign tumors are most often centrally located. They do not infiltrate the surrounding bone, but may grow expansively. The structure of the surrounding bone in benign lesions is more uniform, and the outline of the tumor is more definite. The malignant tumors raise the periosteum, are not definitely circumscribed, and lead to dense ossification of the bone or soft tissues. Rather frequently the benign giant-cell tumor is mistaken for a sarcoma, and sometimes a solitary osteolytic bone metastasis has been believed to be a sarcoma.

The osteogenic sarcoma is the most malignant and the most frequent bone tumor. Ray-like arrangement of periosteal bone proliferation is the most dependable roentgen sign, elevation of the periosteum being important, also. Occasionally a diagnosis cannot be made roentgenologically, especially if the case be early. In 72 per cent, the lower extremities are attacked; the age is usually found to be in the second decennium. Pain, especially at night, is clinically a very early symptom. The prognosis is poor. In Ewing's statistics only 6 per cent remained alive after five years. Early amputation with pre- or postoperative irradiation seems advisable, roentgenotherapy alone offering only palliation.

The extraperiosteal fibrosarcoma is a rare tumor, which shows in a roentgenogram only a soft tissue tumor, sometimes with erosion of the neighboring bone. The prognosis after surgery is better than in an osteogenic sarcoma. Irradiation has no effect.

The "Ewing Sarcoma" (endothelial myeloma) represents about 10 per cent of all bone tumors and is found in young individuals. The diaphysis of long bones is often involved, especially the fibula and tibia; sometimes it is found in the small bones of the extremities or in the skull and vertebræ. This tumor is the only type which metastasizes to other bones. The roentgenogram shows frequently an onion-like layer periosteal bone growth, often with areas of destruction in the bone. A soft-tissue tumor may often be seen. This tumor is very radiosensitive. The prognosis for a permanent cure is poor, as most cases are diagnosed in a late stage.

The multiple myeloma is typified by multiple, small, round, circumscribed areas of bone destruction. New bone formation is absent. A diffuse osteoporosis accompanies the picture in many cases. Skull, ribs, pelvis, and long bones are attacked. Lung metastases are not found, contrary to the case of other sarcomas.

The benign giant-cell tumor (or osteogranuloma) is the most frequently occurring benign tumor. It probably represents an overproduction of granulomatous tissue, occurring after a medullary hematoma or another trauma. It must not be mistaken for an osteitis fibrosa cystica. The roentgenologic film is very characteristic, and difficult only in flat bones. The tumor is usually centrally located and expands the surrounding bone symmetrically; cystic areas of different size may be present. In advanced cases the tumor breaks through the bone into the soft tissues. Usually a few thin bone trabeculæ remain visible in the tumor. A periosteal bone-growth is absent. The prognosis is always favorable. Bloodgood could not find in his review a single occurrence of sarcomatous degeneration. Surgical curettage is followed by recurrence in from 20 to 30 per cent of the cases. Roentgenotherapy is the treatment of choice, as recurrences have not been reported. The tumor shows a definite increase in size after the treatment and begins to decrease only after about two months. Complete ossification can be looked for in about one year. Many cases of this benign tumor have been operated on with the diagnosis of a sarcoma and many bones have been needlessly amputated.

Chondromas and osteomas are considered congenital anomalies rather than tumors. Chondromas grow expansively and often show typical calcification. They are always bounded by a sharp line.

Metastatic bone tumors are diagnosed by their multiplicity, their characteristic localization, and by the knowledge of a primary tumor. The hypernephroma and carcinoma of the thyroid may cause solitary metastasis.

Hodgkin's disease, lymphosarcomatosis, actinomycosis, and the echinococcus disease may simulate malignant tumors, when they attack bones.

H. W. HEFKE, M.D.

Osteogenic Sarcoma Developing in Osteitis Deformans (Paget's Disease of the Bone). A. Ochsner

and I. M. Gage. Surg. Clin. N. America, August, 1930, X, 851-868. (Reprinted from "Cancer Review" by permission.)

The authors found in the available literature thirty-one cases of Paget's sarcoma or osteogenic sarcoma arising on osteitis deformans; every one of the patients died within a short time after the appearance of malignancy.

They describe a case occurring in a man, 61 years of age, with a history suggesting Paget's disease of the right tibia and the skull for about ten years. A year before admission to the hospital he fell and hurt the right knee, and after this noticed gradual swelling and increasingly severe pain. X-ray examination revealed typical Paget's disease in both femora, tibiæ, and ilia and in the skull. In the right tibia there coexisted with this a periosteal sarcoma invading the muscles. The limb was amputated, but death occurred seven weeks after operation. At necropsy there were found metastases to lungs, liver, and mesenteric and mediastinal lymph glands. Despite the very bad prognosis of sarcoma superposed on Paget's disease, the authors regard amputation as justifiable in order to relieve the severe pain.

F. Cavers, D.Sc.

Osteochondromatosis of the Joints. R. Kienböck. Röntgenpraxis, Oct. 1, 1931, III, 895-899.

Osteochondromatosis is a tumor disease of the joints, in which osteomas as well as chondromas are present. There are different types of this disease: some with multiple osteomas and one or several chondromas, and another type with a single exostosis and multiple cartilaginous bodies. The author describes some cases.

H. W. Hefke, M.D.

Osteochondromatosis of the Knee Joint. Paul C. Colonna. Surg., Gynec. and Obst., November, 1931, LIII, 698-703.

This rare pathologic process is seen most often in early or middle adult life, though no age-period is exempt. Pedunculated and loose cartilaginous bodies are formed from the synovial membrane of joints, the knee being most commonly affected. These bodies are thought to represent an overstimulation of a normal process and to begin to grow from the outer fibrous layer of the joint capsule and push their way toward the joint cavity. They grow to different sizes before being cast free into the joint. (The type of injury is the probable deciding factor in the portion of the joint first involved.) The exact cause has not been proved, but a review of many cases gave a history of trauma to the joint, either direct or from irritation produced by wrenching or twisting. Occasional sharp pain followed as well as increased limitation of movement or a feeling of weakness about the joint.

There are at least two types of osteochondromatosis: (1) Those cases in which one or more, usually multiple, loose bodies are free within the joint. These may be of varying sizes—large ones are sometimes three-fourths of an inch in diameter—oblong or round with glistening white, cartilaginous surfaces, often pitted and presenting numerous bosses. Their tendency is to wander about though they often gravitate backward during movement and produce few symptoms. The absence of any area of calcification is noted. (2) The bodies in great quantities were found both free and attached. This type more nearly resembles a neoplastic process, and the earlier cases pass unnoticed on the roentgenogram. In one case reported the whole interior of the joint appeared studded with literally thousands of small, glistening, pearly white bodies about the size of seed pearls. Many of these bodies were attached to the synovial membrane by tiny stalks, others were free within the joint, and many had fused together, this being the only case with a distinctly rancid odor.

In the fourth case report given by the author, the only symptoms present were those caused by mechanical blocking, there being no increase in the joint fluid or local heat or redness. The roentgenogram is regarded as the deciding factor in diagnosis. The treatment is surgical.

D. S. Childs, M.D.

Joint Osteochondromatosis, with Formation of a Sarcoma. Heinrich Reimann and Robert Kienböck. Röntgenpraxis, Oct. 15, 1931, III, 942-944.

Osteomatosis, chondromatosis, and osteochondromatosis of joints are in general benign affections and do not develop malignant changes. That a sarcoma may rarely develop on the basis of these changes is shown by a case, described in detail. Roentgenologic examination of the right knee showed an osteochondromatosis of the usual type, with chondromatous and osteomatous growths; beside it there was a large tumor with irregular, cloudy areas of calcification. The inguinal glands were enlarged. After amputation the pathologic diagnosis was osteochondroma with sarcomatous changes.

H. W. Hefke, M.D.

Tuberculous Etiology of Roentgenologically Demonstrable Cavities in the Carpal Bones. Hans Hanke. Fortschr. a. d. Geb. d. Röntgenstr., August, 1931, XLIV, 188-197.

This paper contributes to the discussion on lesions of the carpal bones in adults, which began with the

publication of Kienböck and Preiser, concerning malacia of the os naviculare and lunatum, and has aroused wide interest. Three cases are reported, which could be observed during several years. They showed at the onset, as outstanding roentgenologic signs, small isolated cavities in the carpal bones. Two of these could be considered definitely tuberculous, as the patients had other bone or joint pathology which followed a clinical and roentgenologic course, compatible with the assumption of such infection. The third patient was considered tuberculous as no other possible explanation could be detected, and the lesion showed regenerative changes in the time of observation and during X-ray treatment.

The difficulty in differentiation between Kienböck-Preiser's malacia, localized osteitis fibrosa (Konjetzny-Kappis), structural anomalies, projective simulation of disease, osteomyelitis, and enchondroma is stressed, and the remarks concerning malacia are of interest.

HANS A. JARRE, M.D.

Periosteal Thickening in Paget's Disease as Well as in Recklinghausen's Disease. H. Meyer-Borstel. Röntgenpraxis, Sept. 15, 1931, III, 830-833.

The absence of periosteal proliferation is one of the diagnostic signs of generalized osteitis fibrosa (Recklinghausen) in Schmorl's opinion, while a Paget's disease shows the presence of it. The author shows in two cases the presence of well-defined periosteal thickening and proliferation. Generally Recklinghausen's disease does not give evidence of it, but in chronic cases (as in the one shown by the author) it may be definitely present.

H. W. HEFKE, M.D.

BONE DISEASES (THERAPY)

Solitary Cysts of the Long Bones. F. Jacoby. Arch. f. klin. Chir., 1931, CLXIII, 386-406. (Reprinted from "Cancer Review" by permission.)

The author describes ten cases, seen during the past three years, of single long-bone cysts, excluding parasitic cysts and those arising in malignant tumors and thus dealing only with localized cystic osteitis fibrosa, cystic benign tumors (fibromas, chondromas, giant-celled brown tumors) and cysts of undetermined origin. Of the ten patients, eight were from 3 to 16 years of age; the others 25 and 40, respectively. In seven there was pathologic fracture.

Curettage of the cyst cavity is the treatment of choice; with suitable splints the fractures healed well, and in all cases (except one lost sight of) normal function of the extremity followed operation. The author emphasizes the need for biopsy since X-ray examination does not suffice to distinguish among a cyst, chondroma, fibroma, osteitis fibrosa, brown tumor, and malignant central sarcoma.

The author does not think that trauma often plays a primary part in the etiology of bone cysts, though it may secondarily affect an already cystic bone by causing fracture or setting up infection. In his ten cases, there was primary trauma in one case and secondary trauma in four.

F. CAVERS, D.Sc.

Osteosarcoma of the Femur Treated by Radiotherapy. M. Delaye. Lyon Chir., May-June, 1931, XXVIII, 338, 339. (Reprinted from "Cancer Review" by permission.)

A 24 year-old soldier had been complaining for four weeks of swelling at the lower end of his left thigh. A radiograph showed a typical osteogenic sarcoma, with marked destruction of the cortex. A large skin incision was made and the tumor freely exposed. Deep X-rays were then delivered directly to the growth, a total dose of 6,000 r without a filter being given in one sitting. The tumor now shows considerable reduction in size. A further report of this case will be of considerable interest as the radiation technic employed is entirely new.

P. J. KERLEY, M.B.

CANCER (DIAGNOSIS)

Studies on the Blood of Persons with Carcinoma. G. Creuzberg, F. Dannmeyer, O. Hartleb, E. L. Lederer, L. v. Noël, J. Schubert, H. Seel, and L. Treplin. Strahlentherapie, Nov. 14, 1931, XLII, 609-709.

This paper deals with studies of the cancer problem carried out by a group of physicians, physicists, chemists, and biologists. Their co-operative plan comprises the following problems: Physicobiologic considerations of the cancer problem; chemical studies on the serum of patients with carcinoma (the "cancer index" and other characteristic factors regarding the cancer diagnosis); spectrometric studies on the blood serum of patients with carcinoma (the "cancer curve"); colloid chemical studies on the serum of man, particularly cases with carcinoma (the "protective index"); animal experiments, and last, clinical remarks concerning the blood studies on patients with carcinoma.

It is utterly impossible to attempt in an abstract to do justice to the tremendous material collected by the authors. Suffice it to say that very definite relations between fatty acids, cholesterol, and acidity of the blood in the serum of healthy persons and

those with carcinoma were established. This led to the creation of the "cancer index." A typical "cancer curve" was seen in the absorption studies if the wave length was plotted against the absorption coefficient of the alcohol-ether extract of the blood serum, prepared according to Noël. A colloid chemical test is also described which offers encouraging possibilities in the sero-diagnosis of carcinoma. These particular studies led to the creation of the so-called "protective index."

Animal experiments concerning the inhibiting effect of blood extracts from patients with and without carcinoma did not show definite results. A few practical remarks of the medical co-worker conclude the article. It is recommended for careful study in the original to all radiologists interested in the cancer problem.

ERNST A. POHLE, M.D., Ph.D.

Carcinomatous Degeneration of Polyp of the Stomach: Report of Eight Personal Cases with Review of Twenty-four Recorded by Others. T. G. Miller, E. L. Eliason, and V. W. M. Wright. Arch. Int. Med., November, 1930, XLVI, 841-878. (Reprinted from "Cancer Review" by permission.)

Besides reviewing twenty-four cases found in the available literature, the authors describe eight cases of their own occurring in a series of 200 operations for cancer of the stomach. They conclude that carcinomatous polypi usually arise in benign adenomatous polypi. Quoting from the authors, "most of the patients showing such malignant change are males (80 per cent), and the age incidence is the same as for mural gastric cancer (83 per cent over 40 years of age). The symptoms are those of any malignant gastric lesion with, in addition, those of the two other common consequences of gastric polypi—intermittent pyloric constriction and hemorrhage. The hemorrhage may be frank or occult; it not infrequently leads to an erroneous diagnosis of primary anemia (three of our eight personal cases). Consequently, gastric polypi should be considered in all cases of unexplained anemia. Roentgenologic study alone often makes the diagnosis of gastric polyp, and malignancy may be suspected on the basis of the clinical picture."

F. CAVERS, D.Sc.

The X-ray Diagnosis of Carcinomatous Metastases in the Lungs. M. Bagliani. Radiol. Med., February, 1931, XVIII, 214-245. (Reprinted from "Cancer Review" by permission.)

The value of radiography for the diagnosis of unsuspected pulmonary metastases is shown by a description of twelve cases. In the author's clinic carcinoma of the breast and carcinoma of the stomach are the most frequent sources of carcinomatous metastases in the lungs. There are two well-known forms: a generalized infiltrative form, known as lymphangitis carcinomatosa, and a nodular form in which malignant nodules are distributed through the lungs. Lymphangitis carcinomatosa is easily recognizable on a radiograph; it runs a rapid course often with pleural as well as pulmonary involvement and does not react to deep X-ray therapy. The nodular form is more chronic. If secondary to breast carcinoma there is usually only one nodule for some time. In some cases the nodules are bunched together near the lung root and in others the nodules are distributed throughout the lower parts of the lungs. The apices are seldom the seat of malignant nodules. Slight improvement may follow deep X-ray therapy in this form of metastasis. The nodular form may be secondary to sarcoma—in such a case the nodules react promptly to X-radiation. The technic for the X-ray examination and the pathology of lung metastases are described in detail.

[It has long been held that, radiologically, metastases to the lungs are not seen in the apices even when there is advanced disease in other parts of the lungs. Improvements in technic and more detailed examination of the apices in such cases disprove this view.]

P. J. KERLEY, M.D.

The Diagnosis of a Primary Carcinoma of the Ureter from the Roentgenogram. H. v. Sauer. Röntgenpraxis, Oct. 15, 1931, III, 935-937.

The diagnosis of a primary carcinoma of the ureter has been made possible only by pyelograms, either by cystoscopy or by intravenous administration. The latter is often of more help, because introduction of a ureteral catheter is frequently impossible. Roentgenograms of such a case are shown. They reveal a filling-defect and partial obstruction.

H. W. HEFKE, M.D.

Carcinoma of the Lung of Long Duration. L. H. Ball. Jour. Coll. Surg. Australasia, November, 1930, III, 286-290. (Reprinted from "Cancer Review" by permission.)

A man, 60 years of age, was found, seven years before his death, to have pleural effusion (verified by X-ray examination), and was admitted to a sanatorium on a diagnosis of phthisis. Later he was discharged as fit for light work. In December, 1928, he was admitted to the hospital on a diagnosis of gastric carcinoma with metastases in the liver. X-ray examination showed a dense shadow over the lower two-thirds of the left lung, with a thick oval line, which was interpreted as the wall of a calcified echinococcus cyst. Barium filling of the stomach

showed displacement of the esophagus to the right and deformation of the duodenal bulb, suggesting the presence of a tumor lying behind the stomach and compressing the duodenum. Neither in the liver nor other part of the abdomen was there evidence of echinococcus cysts. Exploratory laparotomy showed that a tumor was present above the left half of the diaphragm, and later an attempt was made by rib resection to remove this tumor, which proved to be a large, grey, fleshy inoperable mass found on microscopic examination to be a pulmonary carcinoma. The patient died soon after the second operation, and necropsy showed the right lung to be almost entirely replaced by a fetid, necrotic, carcinomatous mass.

F. Cavers, D.Sc.

Cancer Diagnosis by Spectro-photometry. Editorial, British Med. Jour., Aug. 1, 1931, No. 3682, p. 196.

Bendien, of Zeist, Holland, claims to have elaborated a laboratory method for diagnosis of carcinoma by blood examination. The technic consists of two parts.

The first is a flocculation method in which the serum is precipitated with various mixtures of acetic acid and sodium vanadate; this precipitate is dissolved in 2 per cent sodium bicarbonate solution, which is submitted to spectro-photometric examination. From a series of spectrograms the extinction coefficients are obtained, and it is on the basis of the curve so plotted that the diagnosis is made. Bendien's view is that cancer is a local disease which can develop only if a specific abnormality of the serum is present. He is not satisfied yet that he can obtain an accurate diagnosis in every case of carcinoma, but he claims that a positive reaction is never seen in cases of any other disease. A matter of very considerable interest is the fact that Bendien has been unable to discover any specific characters in the serum of cases of sarcoma.

Wallace D. Mackenzie, M.D.

Is Cancer an Infectious Disease? C. Sternberg. Wien. klin. Wchnschr., Jan. 23, 1931, XLIV, 97-99. (Reprinted from "Cancer Review" by permission.)

The author has published many excellent reviews on special aspects of malignant disease, and now adds another in which he deals in a trenchant manner with some recent publications in which some infective agent or other has been proclaimed to be the real *causa causans* of cancer.

He begins by recalling the fact that in the early days of bacteriology living agents were sought as the cause of malignant growths, and also that at that time no clear distinction was drawn between infective granulomas and neoplasms—the difficulty in making such a distinction was pointed out by Virchow in his book on tumors, published about seventy years ago. From these early days down to the present time numerous bacteria, fungi, yeasts, protozoa, etc., found in tumors have been regarded as oncogenic agents, though it has been proved that many of these bacteria, etc., may be found in any tissue and that various saprophytic forms may be easily isolated from a tumor.

The author next gives more definite instances. He considers that Gye's work has been completely refuted. Most of Heidenhain's mouse tumors were obviously spontaneous growths bearing no relation to the injection of human tumor autolysates into the animals; Sternberg agrees in this with Hellner and says the experiments have been repeated in his own laboratory on 400 mice with absolutely negative results. As to Blumenthal's claim to have produced animal tumors with *Bacterium tumefaciens,* he points out that this writer now claims that this organism only sets up inflammation of a precancerous nature, from which a neoplasm may arise; but as other writers have not been able to produce tumors in this way the connection of *Bacterium tumefaciens* with animal tumors may be abandoned. The author does not believe that the Rous sarcoma itself affords any evidence for the parasitic theory of tumors. The Rous sarcoma differs too much from all other known forms of tumor for any results obtained from its study to be applied to the etiology of tumors in general.

The author's general conclusions are summarized in the following sentence: "Parasites, in the widest sense of the term, have no other rôle in the causation of malignant tumors than have injuries due to a great variety of agents of chemical and physical nature; hence it may be asserted definitely that there is no specific cancer agent and that cancer is not an infectious disease."

F. Cavers, D.Sc.

Cancer in Young Persons. E. Wildbolz. Ztschr. f. Krebsforsch., 1931, XXXIII, 681-708. (Reprinted from "Cancer Review" by permission.)

From an analysis of the pathologic material examined in the Institute [Pathological Institute, University, Bern] from 1920 to 1929, which includes autopsies and tumors removed by operation, it is found that of 5,536 cases, 94 referred to patients under 30 years of age. Of these 94 patients, four were children. This gives a percentage of 1.79 of all malignant growths which had been examined and represents a slight diminution when compared with the period from 1906 to 1915. No evidence could be obtained from the clinical history that cancer in young persons is particularly malignant. In a few

patients the appearance of cancer was preceded by a trauma. The most striking example is a carcinoma of the lower eyelid which appeared in a young man, 25 years of age, two months after a piece of hot metal filing had accidentally struck the eye.

There is a good bibliography of previous work on the occurrence of cancer in young people.

W. CRAMER, Ph.D., D.Sc.

Co-existence of Calcified Retrosternal Goiter and Carcinoma of Esophagus. F. J. Collett and R. Bertoin. Lyon Méd., Feb. 1, 1931, CXLVII, 133-136. (Reprinted from "Cancer Review" by permission.)

In a man, 69 years of age, complaining of dysphagia for the last two months, X-ray examination showed at the level of the manubrium sterni a non-homogeneous shadow extending to the aortic arch. The diagnosis was either retrosternal goiter or thyroid carcinoma, and it was decided to make a gastrostomy next day, as the patient had not been able to swallow for five days.

Death occurred during the night. Necropsy revealed a cystic and calcified left thyroid lobe and just below, but free from this, an annular ulcerated tumor of the esophagus, histologically carcinoma, just beginning to perforate into the trachea. The authors add that had esophagoscopy been done during life it would have given the correct diagnosis and supplemented the X-ray findings.

F. CAVERS, D.Sc.

X-ray Diagnosis of Scirrhous Carcinoma of Stomach. L. Turano. Policlinico (Sez. Med.), October, 1930, XXXVII, 469-482. (Reprinted from "Cancer Review" by permission.)

Six cases are described, and the author emphasizes the difficulty sometimes encountered in distinguishing between scirrhous cancer and syphilis, the X-ray investigation alone being usually insufficient. The case history is important, especially because in syphilis several years elapse before the scirrhous-like condition is reached and during this time the patient has suffered more or less severe gastric pains.

F. CAVERS, D.Sc.

Lupus and Carcinoma. A. von Mallinckrodt-Haupt. Dermatol. Ztschr., January, 1931, LX, 138-152. (Reprinted from "Cancer Review" by permission.)

In this interesting paper the author first cites some statistics regarding the frequency of development of carcinoma upon lupus vulgaris. The lowest frequency cited (1.5 per cent) was given by Sequeira; almost the same (1.6 per cent) was observed at the Munich clinic (four cases in 249 of lupus); next, 2 per cent at the Wurzburg clinic, and 2.2 per cent at the Freiburg clinic. Higher figures were reported by Darier (4 per cent) and by Stühmer (41 cases in 832, or 5 per cent).

During ten years the author saw 906 patients with lupus, including 28 with lupus carcinoma (3.09 per cent), in all cases on the face. Clinically the majority showed the ulcerated and rapidly growing granuloma-like type of cancer, little influenced by any form of treatment. Roughly, half of the patients had had X-ray treatment, but the author agrees with Albert in believing that X-ray treatment rarely causes lupus carcinoma when it has been given carefully.

F. CAVERS, D.Sc.

Simultaneous Occurrence of Aortic Aneurysm and Bronchial Carcinoma. Carl Mumme. München. med. Wchnschr., Oct. 2, 1931, LXXVIII, 1704, 1705.

This is a report of a case of aortic aneurysm which, on the X-ray film, showed an increasing density of the lower lobe of the left lung. The gradual increase of this density, together with bloody exudation, led to the diagnosis of a malignancy. At autopsy a bronchial carcinoma with generalized metastasis was found.

E. A. MAY, M.D.

CANCER (THERAPY)

A Clinical Evaluation of Various Qualities of Roentgen and Radium Rays for the Treatment of Advanced Cancer. Bernard P. Widmann. Am. Jour. Roentgenol. and Rad. Ther., November, 1931, XXVI, 729-733.

The author first emphasizes that there is no biological proof of superiority of any particular wave length of radiation in cancer therapy. However, 200 K.V. radiation filtered with 0.5 mm. copper affords greater penetration at varying depths with less danger of skin damage than 127 K.V. radiation using 6 mm. aluminum. Similarly, it has now been proven by two years of practical experience that skin tolerance can be even further increased by combining two qualities of short wave length radiations such as 200 K.V. roentgen irradiation with gamma radium packs (2 mm. platinum). However, end-results studied on a statistical basis of a series of 319 cases of advanced cancer treated by this method indicate that no material improvement over the intensive use of either one of these

agents (roentgen rays or radium) was achieved, although, based on clinical impressions, results from the combined method justify recommending it. By combining qualities of radiation, from 230 to 280 per cent S.E.D. through a given skin area may be given by protracting treatment over a period of from four to six weeks.

J. E. HABBE, M.D.

The Advantage of Bacteriologic Examination before Rådiation Therapy of Uterine Cancer. D. den Hoed. Strahlentherapie, Nov. 14, 1931, XLII, 775-779.

Infection represents one of the most serious complications following radium implantation in cases of carcinoma of the uterus. In order to determine the rôle played by the resistance of the organism in this connection, the author studied the virulence of the bacteria in the vagina by means of the Ruge and Phillipp's test: A small amount of secretion from the cervical ulcer is mixed with 10 c.c. of sterile blood which has been defibrinated. This is then placed on an agar plate in the incubator at 37° Centigrade. Part of the blood is put in the incubator alone. After 1, 2, and 3 hours new samples are taken and new agar plates made. This gives an idea not only as to the type and number of microbes present in the ulcer but also of the bactericidal power of the blood. Patients who have hemolytic streptococci or whose blood has no bactericidal power are treated first locally as well as with vaccines before irradiation.

The author then tabulated the patients according to the reactions observed following radium implantation and compared the period before the Ruge and Phillipp's test was done with the period after it had become a routine. It appeared that without the guidance of the test 32 per cent of the cases had reactions lasting from 3 to 5 days, while of those who had been properly prepared only 6 per cent showed reactions for from 3 to 5 days. The author concludes, therefore, that the Ruge and Phillipp's test is most valuable in preventing undesirable reactions following intra-uterine radium therapy.

ERNST A. POHLE, M.D., Ph.D.

The Carbohydrate Metabolism in Carcinoma of the Uterus after Treatment with Roentgen Rays and Radium. I. Lucas. Arch. f. Gynäkol., 1930, CXLIII, 389-411. (Reprinted from "Cancer Review" by permission.)

The author estimated the blood sugar, dioxyacetone, and lactic acid content in blood, and the alkali-reserve of the plasma, in women with uterine carcinoma before and after treatment with X-rays and radium. The blood sugar showed no constant changes. The lactic acid showed only a transient increase shortly after radiation. From two to four hours after radiation there was a transient lessening, and after twenty-four hours an increase, of the alkali-reserve. After each further radiation there was a slight increase of the alkali-reserve, but a normal CO_2-fixing power was never reached. The increase in lactic acid and the decrease in the alkali-reserve after radiation were simultaneous. A summary is given of the literature on the subject. The CO_2-fixing power in these women was between 40 and 47 c.c. per 100 c.c. plasma, while the normal range, as given by Van Slyke, is from 53 to 77 cubic centimeters.

E. L. KENNAWAY, M.D., DSc.

The Sensitiveness of Carcinoma to Radiation. F. Voltz. Virchow's Arch. f. pathol. Anat., 1931, CCLXXX, 340-342. (Reprinted from "Cancer Review" by permission.)

From a series of close observations on the reaction of patients with carcinoma to radiation of a carefully standardized variety, the author concludes that the red-blonde human type responds less satisfactorily than other human types. He further draws the deduction that the red-blonde type is more predisposed to cancer than other human types. He, therefore, addresses an appeal to all radiation institutes and to all pathologic institutes to supply information about the age, color-type, degree of pigmentation (both in normal and irradiated areas), and other details of all patients under treatment for, or dying of, cancer. This information can be supplied on special forms to be obtained from the author.

C. E. DUKES, M.D., M.Sc.

End-results in the Treatment of Carcinoma of the Cervix with Radium. Lewis C. Scheffey and William J. Thudium. Am. Jour. Obst. and Gynec., August, 1931, XXII, 247-254.

The authors report on 150 cases seen from 1921 to 1930, at the Jefferson Hospital, 140 of which were treated by irradiation. Since 1923, no case of cancer of the cervix, early or late, has been subjected to radical operation, irradiation alone being employed. The age incidence is interesting in that 30 per cent of the cases occurred before the age of 40, the youngest patient being 22. Six per cent of the cases occurred in nulliparous women.

Schmitz' classification was employed, and 111 cases, or 76 per cent, fell under class three. Only sixteen, or 10.3 per cent, of the cases were operable. They conclude from these statistics that patients are not seeking advice at an earlier stage than formerly.

Of the three early cases treated by irradiation alone, all, or 100 per cent, have survived five years. Of the fifty-six inoperable patients seen, fifty of whom were treated, eight have survived for five

years, giving a relative five-year curability of 16.0 per cent and an absolute curability of 14.2 per cent.

All cases, regardless of stage, gave a relative five-year curability of 20.7 per cent and an absolute curability of 18.6 per cent.

COMPARATIVE FIVE-YEAR STATISTICS, IRRADIATION

	All cases reported	Percentage of five-year cures of all cases	Percentage of operable cases with percentage of five-year cures of same
Mayo Clinic	1,094	21.8%	2.1—60.8%
Radiumhemmet	790	20.6%	25.5—40.4%
Mercy Hospital	332	17.5%	21.9—53.5%
Woman's Hospital (N. Y.)	259	24.3%	25.9—57.1%
Rhode Island Hospital	92	17.4%	20.6—57.9%
Jefferson Hospital	59	18.6%	5.0—100%

Their technic consisted of the application of radium in a cervical applicator, a total of 3,600 milligram-hours being employed at the present time. The size and filtration of the applicator are not stated. Monel needles of radium element have been occasionally introduced interstitially, directly into the carcinomatous tissue. X-rays have been employed only occasionally in the past, but following the recommendations of Healy, Ward, and a great many others, they are considering the routine employment of roentgenotherapy in addition to the radium therapy.

JACOB H. VASTINE, M.D.

Skin Cancer, with Special Reference to Hospital Cases at Bern. O. Naegeli. Schweiz. med. Wchnschr., Sept. 6, 1930, LX, 837-842. (Reprinted from "Cancer Review" by permission.)

This is an analysis of 190 cases of primary squamous-celled cancer of the skin and mouth observed from 1914 to 1928 and representing an annual average of 0.85 per cent of the total skin lesions seen during this period. Basal-celled forms were eight times more frequent than squamous, and the sex incidence was unusual in that women were nearly as often affected as men. As to age incidence, no cases were seen below the age of 20, only four below 30; the disease increased rapidly after the fifth decade and fell slightly after the seventh. In more than half the cases the upper part of the face was affected. After giving a list of fourteen precancerous skin lesions, the author says that cancer on a precancerous basis was most often associated with senile keratosis; in three cases each with leukoplakia and Bowen's disease; in two cases each with tertiary syphilis, lupus vulgaris, and Paget's disease; in one case each with lupus erythematodes, X-ray dermatitis, nevus, phimosis.

As to treatment, surgery has been used in nevi and in carcinoma of the lips, tongue, and external genitalia, also in all cases of prickle-celled cancer; radiotherapy (with X-rays or mesothorium) in benign growths, in inoperable cancers, and following surgery. In X-ray treatment a single dose of from 15 to 30 units with 3 mm. Al filter is given as a routine; the author states that larger doses give no better results. No cases were treated by electrocoagulation, freezing, or caustics.

F. CAVERS, D.Sc.

Electrosurgery in Malignant Disease. G. A. Wyeth. Internat. Jour. Med., September, 1930, XLIII, 479-481. (Reprinted from "Cancer Review" by permission.)

In this brief note the author assumes that tumors of low differentiation, *i.e.*, showing embryonic features, are of unfavorable surgical prognosis but are highly radiosensitive, and that Broders' classification of tumors is correct, *i.e.*, that the highly differentiated tumors of Grade I are relatively benign while those of Grade IV represent the opposite extreme. He states that for Grade IV cases, Cutler and Healy report 43 per cent of cures by radiotherapy, while the Mayo Clinic statistics report only 9 per cent cures by surgery. Hence, biopsy is essential and should be made by diathermic methods. The author invariably uses electrosurgery for operable tumors and claims that this treatment also gives good palliative results in inoperable cases. Many tumors of Grade IV should not be immediately treated surgically, but first given radiotherapy. Above all, treatment should not be schematic and one-sided.

F. CAVERS, D.Sc.

Results of Radiation Therapy in Inoperable Carcinoma of the Cervix (from 1920 to 1927). E. Mühlmann. Strahlentherapie, Oct. 24, 1931, XLII, 504-509.

Before reporting the results obtained in cases of inoperable carcinoma of the cervix, observed during the years from 1920 to 1927, the author briefly reviews the patients seen from 1915 to 1920. In a brass filter of 0.5 to 1.5 mm. thickness 25 mg. of radium element were used. From 5,000 to 10,000 mg.-hrs. were given in the cervical canal or within the growth. Some cases received, in addition, X-ray therapy which, of course, must be considered insufficient in the light of our present knowledge. The first group observed five years or longer consisted of thirty patients, five, or 16.6 per cent, of whom were clinically cured. In the second group, consisting of twenty patients observed from three and one-fourth to six years, three, or 13.6 per cent, were cured. In 1920, a deep therapy apparatus was installed and the patients were treated according to the method of Seitz and Wintz. They were observed from one-half to two years following the treatment;

six out of sixteen patients, or 37.5 per cent, were clinically cured.

The method of treatment used, beginning in 1920, was changed very little. The radium available had been increased to from 50 to 75 mg., which was distributed in seven tubes placed in the cervical canal, within the cauliflower growth, or in the fornix of the vagina. Within a week 3,000 mg.-hrs., distributed over 3 or 4 sittings, were given. From eight to ten days later from 100 to 110 H.E.D. X-ray deep therapy were applied. From 1920 to 1922, the Seitz-Wintz method was used, and beginning in 1923, the large field method of Dessauer-Warnekros. In 1924, another method was introduced, using two large anterior and posterior fields and two lateral fields. A total of 238 inoperable carcinomas of the cervix were irradiated with the combined method. After five years, forty-six patients, or 19.74 per cent, remained clinically free from the disease. The author compares this figure with the cure of 16.6 per cent obtained during the period from 1915 to 1918, in thirty cases treated by radium alone. He concludes that the combined therapy has not materially improved the results obtained by radium alone, and suggests, therefore, that the protracted fractional method of Coutard be given a trial.

ERNST A. POHLE, M.D., Ph.D.

Advances in the Method of Treating Carcinoma of the Gastro-intestinal Tract by Roentgen Rays. Hans Holfelder. Strahlentherapie, Oct. 24, 1931. XLII, 497-503.

Carcinoma of the stomach can be influenced favorably in about 50 per cent of the cases by intensive X-ray therapy. From 20 to 25 per cent of these patients do not show any evidence of tumor after completion of the treatment. The scirrhous type of carcinoma does not respond as well. The principle of the method is the use of a number of small fields of 6×8 sq. cm. with compression by means of a treatment cone. On the first day usually two or three fields are used; on the second day two fields, and then daily after that only one field for a period of from four to six weeks. The single dose per field is 300 r (in air), each field receiving a total of from 2,400 to 3,000 r. The technic is similar in cases with carcinoma of the rectum.

Two cases are briefly related illustrating the results which sometimes can be obtained by this procedure. One woman, 53 years of age, was operated on in October, 1928, at the Mayo Clinic. The upper three-fourths of the stomach, including all the posterior wall and part of the anterior wall, was involved with carcinoma. There were also considerable metastases to the neighboring lymph nodes as well as in the omentum. A gastro-enterostomy was not done because there was no obstruction. She started treatment under the author's supervision in December, 1928. She improved considerably, gained weight, and roentgen examination about one year later showed a perfectly normal stomach. In June, 1931, the patient was still well and free of recurrence.

The second case concerned a man, 59 years of age, operated on in the University clinic in Heidelberg, in June, 1929. A carcinoma the size of a fist was found to be adherent to the pancreas. Roentgenotherapy was carried out from August to November, 1930. Roentgenograms are appended showing the slow regression of the tumor until there was complete disappearance. The general condition of the patient also improved markedly. In October, 1931, he was still free from recurrence. The method employed by the author is, therefore, recommended to radiologists for trial in similar cases.

ERNST A. POHLE, M.D., Ph.D.

Multiple Epitheliomas of the Trunk Associated with Parapsoriasis. W. Curth. Dermatol. Ztschr., February, 1931, LX, 256-260. (Reprinted from "Cancer Review" by permission.)

A woman showed numerous epitheliomas and many patches of parapsoriasis, but nowhere was there a transition from the latter to the former; several sections of both lesions were examined. The epitheliomas cleared up after electrocoagulation followed by X-ray treatment, but the parapsoriasis was intractable to all the remedies tried. The author believes that multiple epitheliomatosis is becoming more frequent [a perusal of current dermatologic literature certainly shows an increasingly large number of case reports].

F. CAVERS, D.Sc.

Summary of Our Experience in the Use of Endothermic Methods in Cancers of the Skin and Mucous Membranes. N. Puente Duany, E. Fonts, and M. C. Gomez. Bull de l'assn. franç. p. l'étude du cancer, July, 1931, XX, 561-574.

The authors are quite enthusiastic over the results obtained by electrocoagulation and the electric bistoury in the past three years. So successful have they been with these endothermic methods that they give them preference over radium. The advantages claimed are that radiotherapy is always longer, and besides the element of time, a larger quantity of radium is made accessible for cases requiring this substance. These endothermic methods facilitate the treatment of a greater number of patients than would be possible with radium treatment.

The electric bistoury has the advantage of bloodless operations on nevi, angiomas, fibromas, etc. The choice of method, either electrocoagulation or the electric knife, or both combined, depends on the size and character of the tumors, which are divided

simply in three classes: Incipient, small, and large. In the first category are included spinocellular epitheliomas, melanomas, nevi, etc., not larger than a pea. In these the disease is completely localized, infiltration very discrete, and cure is practically 100 per cent. In the second group are found tumors varying from a pea to a one- or two-franc piece, and in the third group, tumors of large size. However, size is not always proportionate to gravity; localization, infiltration, and lymphatic invasion make these forms less accessible to endothermic methods. Almost every advantage offered by radium in cutaneous tumors can be accomplished by electrocoagulation or the electric bistoury.

Electrocoagulation alone is employed in cutaneous cancers of small size, also in tumors of the conjunctiva and lids; the proximity of the eyeball very often interferes with the use of radium on account of more or less irritation. Electrocoagulation is also frequently resorted to in those cases in which small islets have remained undestroyed after radium therapy.

Small recurrences on extensive scars of the mouth or skin are well treated with the electric knife followed by electrocoagulation. Epitheliomas of the skin of the face, which have been uninfluenced by radium, yield to endothermic methods. One of the principal uses of the electric bistoury is the treatment of advanced cases.

HENRY BAYON, M.D.

Diathermocoagulation in the Surgical Treatment of Cancer. F. F. Carranza. Bol. Inst. Med. Exp., December, 1930, VII, 1339-1357. (Reprinted from "Cancer Review" by permission.)

After discussing the advantages and drawbacks of electrocoagulation, its possibilities in combination with surgery and radium, and its technic, the author gives an account of its use at the Buenos Aires Cancer Institute, in the treatment of carcinoma of the uterine cervix (100 cases), breast (29), vulva (17), and rectum (12), reporting a definite improvement in results as compared with other methods that have been used there.

F. CAVERS, D.Sc.

Radiotherapy of Cancer of the Uterine Cervix at the Anticancerous Center of a Parisian Suburb. Statistics of the Years 1921 to 1926. Simone Laborde and Y.-L. Wickham. Bull. de l'assn franç. p. l'étude du cancer, July, 1931, XX, 458-475.

The statistics cover a period of ten years. Although, inasmuch as cancer is concerned, if five years after treatment there has been no recurrence, the case is usually regarded as cured. However, the authors consider that figure as too arbitrary, since return of the disease has been observed after a much longer time. They have consequently carried their observations for ten years, from 1921 to 1926, extending them from this time to 1931, noticing, as is naturally expected, that the percentage of cures declines but slightly after five years, since, after a time, death is often the result of intercurrent disease.

In these observations, cancers of the cervix alone, treated by radiation, figure, cancers of the vagina and post-operative recurrences having been eliminated. Epitheliomas of the cervix have been classified in four groups, according to the different degrees of extension of the lesions:

The first degree comprises lesions entirely limited to the cervix and considered operable.

The second degree includes a juxta-uterine extension with uterine mobility partly preserved; this group comprises cases at the limit of operability.

The third degree includes cases in which there is an invasion of the parametrium or of a part of the vaginal wall, with immobility of the uterus; consequently, they are absolutely inoperable.

The fourth degree comprises cases in which neighboring organs (vagina, bladder, rectum) are involved and for which treatment was instituted only as a palliative measure.

Five tables are submitted for each year from 1921 to 1926, with the purpose of showing: (1) The number of patients examined for cancer of the cervix; (2) the number of patients treated; (3) the number of patients not treated and the causes of their elimination; (4) the number of patients, living and without recurrence, in each of the categories.

Following these data, their sum total is condensed in two tables, the model of which has been devised by the Sub-commission of Radiology and the Cancer Commission of the League of Nations. In these two tables are enumerated the number of cases treated, the number of deaths, and the percentage of cures in each year from 1921 to 1926, and from 1926 to 1931. Also, the total percentage of cures in each of the four degrees in five years and in ten years, showing the rapid decline of cures, as would naturally be expected considering the stage of disease (80 per cent in the first degree, 50 per cent in the second, and 22 per cent in the third). Patients in the fourth stage usually survived but a few months, and in these cases treatment was expected to accomplish no more than palliation of painful symptoms.

Utero-vaginal curietherapy alone has been resorted to for cancers of the first degree. In cases of the second and third degrees, roentgenotherapy is associated with curietherapy; roentgenotherapy is usually applied alone in cancers of the fourth degree. In the extensive forms involving the vagina, the use of radium involves the risk of hastening perforation of the vaginal walls. Surgical treatment following curietherapy has been discountenanced.

When extensive cervical granulations are present, even though the cervical canal is free, it is better to carry out the treatment in two stages, the destruction of the granulations which are always infected allowing intra-uterine irradiation to be carried out with less risk of infection. In these cases an interval of five or six days separates the vaginal from the intra-uterine irradiation.

The authors disapprove of the destruction of exuberant cervical granulations by the curette or by electrocoagulation, as these methods favor infection. Doses usually employed, which have proved most favorable, vary between 5,000 and 7,000 milligram-hours, larger doses often being harmful as they interfere with cicatrization.

The authors condemn short irradiations of a few hours, such as is the custom in America, nor do they approve of irradiations prolonged from twenty to twenty-five days, which, on account of frequent manipulations, might be followed by infection. They consider an average duration at from four to six days, when the irradiation can be accomplished in one stage.

An attempt is made to establish the effect of treatment according to the histologic form of cancer of the cervix, as some forms are more radiosensitive than others, and after a lengthy discussion they finally conclude that treatment is successful in proportion to the degree of invasion, regardless of the histologic type.

In conclusion, the statistics here presented demonstrate that the number of uterine cancers in the first degree which were treated by radiotherapy in this series is small. However, the authors are receiving more patients referred to them by internists and surgeons. It seems that radiotherapy is gradually superseding surgery in the treatment of cancer of the uterine cervix.

HENRY BAYON, M.D.

CHEST (DIAGNOSIS)

Three Interesting Lung Cases. F. Forman. Jour. Med. Assn. South Africa, Aug. 22, 1931, V, 515-519.

I. *Syphilis of the Lung.*—A female, 37 years of age, was admitted to the hospital, complaining of cough with expectoration. For nine months prior to admission she had noticed cough, weight loss, night sweats, capricious appetite, and nausea and vomiting.

Physical examination showed evidence of moderate weight loss. The left side of the chest was flattened, showed restriction of movement, was dull to percussion, with increased tactile fremitus and bronchial breath sounds. There was also tachycardia and rather high temperature.

X-ray examination revealed diffuse nodular infiltration of the entire left lung, with glandular enlargement in each hilus, the appearance being considered suggestive of tuberculosis. Sputum examination was, however, repeatedly negative, while the blood Wassermann was positive. While there was no clinical evidence of syphilis, under anti-syphilitic treatment the patient made rapid improvement. X-ray study about one month after admission showed almost complete resolution of the process in the left lung; hence it was no longer felt that the lesion was tuberculosis.

While the writer recognizes the fact that the therapeutic test is not conclusive, he nevertheless considers the accumulated evidence distinctly in favor of the diagnosis of pulmonary syphilis in this case, and believes the occurrence of this form of syphilitic disease to be more frequent than is generally considered.

II. *Pulmonary Actinomycosis.*—An European male, 22 years of age, was admitted to the hospital, with a swelling of the right fifth rib. He was known to have been running a temperature for the past six weeks and had a slight cough with scanty greenish-yellow sputum.

About five years prior to admission he had been ill with pain in the right chest, and cough. During this illness he had on several occasions coughed up large quantities of malodorous pus, these copious expectorations being followed shortly by almost complete recovery, except for slight cough and scanty sputum.

Examination revealed a pulse of 90, temperature of 100°, and dullness over the right base and in the mid-axillary line. There was a small swelling over the lower half of the right fifth rib in front, the swelling being firm and elastic, not red, but adherent to the underlying rib. This was incised, typically actinomycotic pus with golden granules being evacuated, and the ray fungus was demonstrated.

X-ray study on admission showed a small patch of nodular infiltration at the right base but no evidence of rib abnormality. During his stay in the hospital he developed first a left-sided pleural effusion and later a right-sided effusion, each of which cleared rather promptly. Fluid withdrawn from the right pleural cavity was clear and sterile. Sputum studies were persistently negative for tubercle bacilli, ray fungus, or any demonstrable organism. Final X-ray study some months after first admission to the hospital showed an essentially negative chest. The therapy in the meantime had been large doses of iodides and vaccine therapy. It was assumed that the chronic lung condition was actinomycotic, with apparent recovery.

III. *Amebic Abscess of the Lung.*—A male, 31 years of age, was admitted to the hospital with a temperature of 102.6°, pulse of 108, and respirations of 32, his complaints being cough, with copious expectoration of pinkish, foul-smelling sputum, and diarrhea, with mucus in the stools. For a number of months prior to admission these symptoms had been present in variable degrees.

Examination showed flattening and limitation of motion of the right lower chest, dullness to percussion from the inferior angle of the scapula downward, with tubular breathing, numerous moist sounds, and diminished vocal fremitus. The liver edge was felt three inches below the costal margin and was quite tender to palpation. Sigmoidoscopic examination revealed numerous typical amebic ulcers. The diagnosis was amebiasis, amebic dysentery, amebic hepatitis, with abscess extending to involve the base of the right lung with pleural effusion.

X-ray examination revealed a moderate quantity of fluid. After this was withdrawn a lung abscess, not connected with the diaphragm, could be demonstrated.

Under anti-amebic treatment (emetine, yatren, and stovarsol), he made rapid and complete recovery.

J. E. Habbe, M.D.

A Report of Two Cases of Localized Pleural Effusion in Heart Failure. J. Murray Steele. Am. Heart Jour., December, 1931, VII, 212-222.

The author cites the rare cases of localized pleural effusions attributable to heart failure, and adds two cases of his own: one with an effusion localized in the upper half of the right thorax, and the other with an effusion encapsulated in the right interlobar fissure.

Both patients had clinical signs of heart failure, and chest plates showed the localized effusions and enlarged hearts. After recession of the cardiac symptoms, chest studies showed the disappearance of the fluid and reduction in cardiac size. Recurrence of the heart failures showed in each instance a reaccumulation of the fluid and dilated hearts. One patient recovered from his second attack and showed once more the disappearance of the fluid and reduction in heart size; the other patient died, and autopsy revealed the dilated heart and localized pleural effusion. The fluid proved to be a transudate, confirming its origin in the heart failure.

Further, autopsy revealed on the right side a thickened pleura that had obliterated the entire pleural cavity except in the region of the effusion. This finding and a similar instance in the literature lead the author to conclude that localized pleural effusions in heart failure depend upon a pre-existing adhesive pleurisy.

Nathan Flax, M.D.

Roentgenologic Observation of Recurrent Perifocal Inflammatory Processes in Chronic Bronchiectasis. Gerhard Strocka. Röntgenpraxis, Sept. 15, 1931, III, 839-843.

The clinical differentiation between retention of secretion in bronchiectasis and perifocal (pneumonic) lesions is very difficult. The bronchopneumonic areas are usually too small for clinical detection, a roentgenologic examination being helpful. Sometimes the complication of bronchopneumonic foci around the bronchiectasis might be the first sign of the disease. Certain cases of that nature are reported. To the author it appears questionable whether the temperature and acute sickness, supposedly caused by retention in bronchiectatic cavities, may not be due to a perifocal infection.

H. W. Hefke, M.D.

Bronchial Neoplasms: Roentgenologic Aspects. W. F. Manges. Arch. Otolaryngol., December, 1930, XII, 732-738. (Reprinted from "Cancer Review" by permission.)

The author deals with diagnosis, emphasizing especially the importance of bronchography and of biopsy. As to treatment, he advises large doses of X-rays over several fields. He mentions two cases which are alive six and one-half and seven years after the diagnosis was made (but does not state whether or not this was histologically verified).

F. Cavers, D.Sc.

The Borderline between Normal and Pathologic in the Chest Roentgenogram. Felix Fleischner. Röntgenpraxis, Oct. 15, 1931, III, 913-926.

The many different appearances of normal and pathologic chest roentgenograms are described. Particular attention is called to borderline cases, in which it is difficult to say whether the findings should be considered pathologic or a variation of the normal. Emphasis is laid on the importance of good chest films, which should be made with as low a voltage as possible and in as short a time as possible. Many points are given which help to interpret the roentgenologic signs.

This very interesting article cannot be reviewed here in detail, but must be commended for study in the original.

H. W. Hefke, M.D.

Encysted Empyema, with Special Plate. N. D. Patel. British Med. Jour., Dec. 5, 1931, No. 3700, p. 1032.

Encysted empyemas are not very rare conditions. They are difficult to diagnose without the help of X-ray, lipiodol, exploratory needle, or artificial pneumothorax. The collection of pus, often pneumococcal, but sometimes tuberculous, may occur in one of the interlobar fissures, between the diaphragm

and the under surface of the base of the lung, between the lung and the pericardium, or in the general pleural cavity, in the pockets formed by the adhesions of the parietal and visceral layers of the pleura.

A case is reported at length of a collection of pus in a rare position, namely, between the lung and the right margin of the heart.

X-ray examination of the chest showed that the heart was normal in size and in position. The lungs also showed no lesions but a triangular shadow opposite the right second and third costal cartilages just above the right border of the heart. It was homogeneous, and had clearly defined margins. A diagnosis of an encysted empyema was made.

WALLACE D. MACKENZIE, M.D.

Destructive Processes in the Sternum. Adalbert Löw-Beer. Röntgenpraxis, Sept. 15, 1931, III, 817-830.

The roentgenologic demonstration of the sternum is somewhat difficult, as it must be projected away from the shadow of the spine and the mediastinum. Neoplastic processes, as well as inflammatory processes, may lead to areas of destruction in the sternum. Six cases are described: One of metastases from a thyroid carcinoma; one of metastases from a breast carcinoma; another shows a diffuse invasion by tumor tissue, which probably was a sarcoma; a fourth case shows roentgenologically areas of destruction without proliferation (autopsy proved the presence of a sarcoma secondary from a retrobulbar tumor); the fifth was a case of syphilis, and the sixth, one of chronic osteomyelitis. The localization of the changes was in the manubrium in the fifth and sixth cases.

H. W. HEFKE, M.D.

X-ray Diagnosis of Diseases of the Chest. Proc. Royal Soc. Med., Sect. of Radiology, Nov. 20, 1931. British Med. Jour., Nov. 28, 1931, No. 3699, pp. 990-992.

In discussing pulmonary tuberculosis it was concluded that definite infiltration could be demonstrated on the X-ray film as soon as there was any clinical evidence, and that the film usually showed far more evidence of disease than was obtainable by means of physical examination.

Passing on to consider lung abscess, the non-entrance of lipiodol was stressed as the greatest confirmatory evidence available, as lipiodol rarely enters a lung abscess.

As to benign neoplasms, it must be remembered that they were benign only in the pathologic sense. All are extra-pulmonary, the commonest being fibromas, which grow almost invariably from the posterior thoracic wall, and very often from the head of a rib. Teratomas are anterior in position, more irritant, irregular in shape, and cause adhesions to lung tissue from which they are not easily separated. The diagnosis is made from the perfectly straightforward evidence of a film in the lateral plane, in which the growth is seen to have its origin from the mediastinum in the anterior part.

The commonest malignant condition of the lungs, namely, primary bronchial carcinoma, is apparently increasing. This increase is probably due to improved methods of diagnosis in the last twenty years. Carcinoma is classified in the simplest possible way, namely, the two forms in which the disease is most often seen: the lobar, or pneumonic, and the hilar form. The former is due to a combination of growth and collapse; in the hilar form there is growth without collapse, and this might be readily converted into the lobar or pneumonic form.

The thoracic contents are always diminished by primary lung cancer. On closer study of a radiograph of lobar carcinoma it is observed that the opacity is most dense near the root, and diminished in intensity towards the periphery. There is no doubt but that carcinoma of the lung is the commonest cause of bronchial stenosis and of phrenic paralysis. The nerve is at first compressed, and later infiltrated, by the glands.

A less well-known disturbance associated with carcinoma of the lung is compression or invasion of the vagus. The resulting effect is disturbance of the cardiac rhythm, not to be distinguished antemortem from malignant invasion of the heart muscle. Much more often abdominal symptoms result from vagal irritation in the thorax, the commonest being complete or partial gastrospasm, while in rarer cases there may be spasm of the lower end of the esophagus. Very rarely a lung cancer compresses the esophagus directly and gives rise to vomiting.

The visualization of large bronchial or mediastinal glands is a most valuable diagnostic point, and one of considerable significance, as it contra-indicates surgical intervention. The chief conditions simulating lobar carcinoma are: tuberculous pneumonia, syphilis, and aneurysm, but it should not be forgotten that a combination of aneurysm and growth is possible.

It is doubted whether or not to-day abdominal operation for malignant growth is justifiable before an X-ray film of the chest is taken, as it is useless to operate on a malignant mass in the stomach when there is a carcinomatous growth in the chest.

WALLACE D. MACKENZIE, M.D.

CHEST (THERAPY)

Contribution to the Roentgenotherapy of Actinomycosis of the Lungs. Max Lüdin. Strahlentherapie, Oct. 24, 1931, XLII, 466-470.

Reports in the literature regarding unsatisfactory results with roentgenotherapy in actinomycosis of the lungs usually state that in spite of high doses the patient did not improve. The author describes a case of this type, with involvement of the left lower lung and fistula. Potassium iodide was not very effective. Roentgenotherapy was given through four fields over the diseased part of the lungs, each field receiving 200 r (160 K.V., 8 mm. Al, 25 cm. F.S.D., 10 × 10 sq. cm. field). Following this first series of X-ray therapy the patient improved considerably. The fistula closed, pain temporarily disappeared, and the general condition was much improved. Following a three months' sojourn in Switzerland, the patient received a second series and at the same time potassium iodide was given internally. He has gained 8 kilograms since the first treatment. The roentgenogram shows only thickening of the pleura. This case is undoubtedly clinically cured. Although one case does not definitely prove the efficacy of roentgenotherapy in actinomycosis of the lung, it is suggested that the same dosage be tried in similar cases.

ERNST A. POHLE, M.D., Ph.D.

CONTRAST MEDIA

Some Sialograms. L. N. Pyrah and P. R. Allison. British Med. Jour., Dec. 5, 1931, No. 3700, pp. 1028-1030.

The lipiodol injection is made with a metal syringe and a modified lachrymal duct needle made of silver, having a blunt, slightly bulbous end. It is malleable, and the curve can be adjusted to suit any given case. The needle is fitted to the body of the syringe by a screw attachment. The syringe, needle, and lipiodol are warmed, so that there is then no difficulty in driving the lipiodol through the rather fine-bore needle.

Parotid Gland.—The needle of the loaded syringe is brought up to the orifice of the duct and is steadied by the surgeon resting it upon his left thumb. It is slid into the duct for about an inch. The introduction of the needle causes a slight cutting pain, but not sufficiently intense to cause undue discomfort.

The injection is continued gently until the patient experiences a sensation of discomfort in the region of the parotid gland; this indicates that the finer ducts are filled with lipiodol. From about 0.5 to 1 c.c. is used. The needle is quickly but gently withdrawn, and the patient is immediately placed in the recumbent position on the X-ray table.

Submaxillary Gland.—The needle is introduced as before, but the procedure usually presents more difficulty than in the case of the parotid duct.

The X-ray technic is as follows:

(1) *Parotid Gland.*—The patient lies on his side, and the radiographer places the head (as accurately as possible) in the lateral position, so that the two rami of the lower jaw are superimposed. The head is hyperextended so as to open up the space between the jaw and the vertebral column. The mouth is opened and is retained in this position by a cork, which is placed between the incisor teeth. With the patient in this position, the greater part of the shadow of the gland is in front of the shadow of the cervical vertebræ.

(2) *Submaxillary Gland.*—A lateral radiogram is taken here. The patient's mouth is fully opened and the tongue is pressed upwards to the roof of the mouth. There is usually no shadow of bone overlying that of the gland, but in some cases the hyoid shadow may be superimposed.

The uses of sialography are listed as follows:

(1) In some cases of chronic parotitis with subacute exacerbation, sialography reveals that one essential feature in the pathology of the disease is a dilatation of the ducts and of the alveoli.

(2) A sialogram is of value in helping to decide whether a tumor in the neighborhood of a salivary gland is derived from the gland tissue or from adjoining structures. In the former case the gland may be largely destroyed and there may be a considerable filling defect on the sialogram, while in the latter case, even though the gland may be somewhat displaced, it will show normal filling.

(3) Injection of lipiodol may be of assistance in the localization of calculi.

(4) The precise position and track of a salivary fistula, more especially of the parotid gland, can be traced very easily by means of a sialogram.

WALLACE D. MACKENZIE, M.D.

A New Method for the Injection of Lipiodol. Ernest Fletcher. British Med. Jour., Nov. 7, 1931, No. 3696, p. 846.

There are two possible methods of injection: the intralaryngeal (usually called the oral route), and injection through the crico-thyroid membrane direct into the larynx.

An attempt has here been made to simplify the technic of injection through the crico-thyroid membrane and to dispense with the necessity of a general anesthetic for child cases.

The apparatus is a 20 c.c. syringe with a barrel greater in diameter and thus shorter in length than the one generally in use. The usual thumb-piece has been replaced by a lever. The piston is attached to the working arm of this lever by a rod, and into the other arm is screwed the barrel of the syringe. The rod is attached to the piston by a universal joint. A spring is inserted between the two arms of the lever to keep them constantly apart and to bring the piston up the barrel. To the end of the

barrel is attached a bayonet joint. A filling tube is provided. A special trocar-pointed needle with lateral holes fits the syringe. On this needle a shoulder may be placed, if desired, to prevent its penetrating the larynx beyond a certain point.

The injection may be made through the crico-thyroid membrane or between two of the upper rings of the trachea, and has been found more rapid, painless, and efficient than other methods previously in use for injection through the crico-thyroid membrane.

The original article gives the name of the makers of a syringe of this type.

WALLACE D. MACKENZIE, M.D.

CYST

Paradental and Traumatic Cysts of the Jaw. O. Schneider. Ztschr. f. Stomatol., January, 1931, XXIX, 80-96. (Reprinted from "Cancer Review" by permission.)

The cysts dealt with here are to be distinguished from the better known radicular and follicular dental cysts. The author first describes two cases of paradental cysts (in a man, 44 years of age, and a woman, 50 years of age). These resemble ordinary dental cysts in general structure; the epithelial lining is produced by reactive proliferative growth, corresponding to what is sometimes seen in gingivitis. He then deals with three cases of traumatic bone cysts of the jaw, which are devoid of epithelial lining or may contain epithelium derived secondarily from the buccal mucosa.

The author says these cysts have nothing to do with localized osteitis fibrosa but form an independent lesion arising by medullary hemorrhage. They are, therefore, commoner in the lower jaw, which has a single central artery. There is a list of fifty-one references (all German), beginning with Virchow (1876). The roentgenograms are good.

F. CAVERS, D.Sc.

Hydatid Disease in England. James F. Brailsford. Brit. Jour. Radiol., September, 1931, IV, 440-450.

In man the average frequency of hydatid cyst locations are: Liver 70 per cent, lungs 10 per cent, kidney and spleen, each 2.5 per cent, other abdominal organs 5 per cent, muscles and cellular tissues 5 per cent, brain 5 per cent, and bone 1 per cent. In the lungs the cyst may rupture into a bronchus and cure take place; however, the same accident may produce serious hemorrhage, pulmonary edema, shock, and even death. Of human infections 25 per cent show multiple cyst involvement.

Recognition of hydatid infection may first take place through roentgenologic study. Most commonly, of course, the chest findings are most suggestive. The appearance of the cyst will depend upon its condition; hence if simple and unruptured, it will be represented by an ovoid shadow, uniform in density, and with sharply defined margins, with no changes from the normal in the surrounding lung tissue. The lesion may be either single or multiple. If, however, the cyst has ruptured into a bronchus, it may be entirely empty and simulate a "pleural ring." Occasionally the cyst wall undergoes calcification. Differentiation must be made from fibroma, primary or metastatic sarcoma, dermoid cyst, pyemic abscess, and aneurysm. Hydatid cyst formation in the abdominal organs or skull is much more difficult to demonstrate and recognize, although occasionally the abdominal cysts will show calcification of their walls and the intracranial cysts may produce erosion of the inner table or displacement of the pineal gland. Positive precipitation and intradermal tests contribute greatly to the diagnosis, while the finding of hydatid membrane, scolices, or hooklets in the sputum, vomitus, or excreta is the most conclusive evidence of the disease.

J. E. HABBE, M.D.

DIATHERMY

Electrical Treatment of Neuritis and Writer's Cramp. W. Black Jones. British Med. Jour., Sept. 19, 1931, No. 3689, p. 531.

The method adopted by Davies consisted, first, of testing for the affected spot; the negative pole of a faradic current is connected with a conical-shaped electrode covered with wash-leather, the positive being a large pad, which is connected to the arm or leg. Both electrodes are moistened with saline solution. The faradic current is so regulated that it will excite pain in the diseased spot, but will not cause pain in a healthy nerve. When the spot is touched with the electrode and pain is felt, the position is marked. The second stage is that of treatment, and for this purpose the galvanic current is employed. An insulated needle is connected with the negative pole, the large pad remaining positive. A local anesthetic is next injected under the dermis, the needle is inserted, and the current is turned on; the needle is directed to the point at which the pain is most acute. The current should not exceed 6 ma.; the needle is withdrawn after ten minutes.

Here the technic is modified slightly. The current generally used does not exceed 1 ma.; frequently it is 0.2 milliampere. It is found that five minutes is sufficient for the treatment; frequently after four minutes the patient states that the pain is diminishing. Two spots are often treated at one sitting.

The general results of the treatment show that in cases in which one or two spots occur on a par-

ticular nerve, the action of the current gives immediate and permanent relief. If the faradic current is again applied to the spot after an interval of a few days and no pain is felt, it is concluded that the spot is cured. Thus, when a spot has been treated, no second treatment is necessary. Occasionally when a spot is found there may be felt under the skin a small nodule, which disappears with the application of the galvanic current; the nodule may be a deposit of uric acid. On the other hand, when the number of spots is multiple and when they are close together, the results are not so satisfactory and the relief is often only partial, or it may be some time before a moderate amount of success is obtained; this is assisted by the internal administration of iodine.

Illustrative cases are reported.

WALLACE D. MACKENZIE, M.D.

DOSAGE

Our Experience with the Protracted Fractional Dose Method. W. Dieterich and J. Umbach. Strahlentherapie, Oct. 24, 1931, XLII, 510-513.

The authors tried the method of Coutard in a number of advanced tumor cases. Their technic was as follows: 219 K.V., 4 ma., 3 mm. Zn, half value layer in Cu 2.1 mm., 40 cm. F.S.D., 10×15 cm. field; H.E.D. $= 550$ r. Each area received 185 r in one sitting, and this dose was repeated every other day until 3,000 r had been applied. The treatment extended over a period of four weeks. Practical experience seemed to show that less filtration, for instance, 0.5 mm. Zn + 1 Al leads to similar results.

It is assumed, therefore, that not the heavy filtration, but the distribution of the total dose over a long period represents the most important factor of the method. In certain patients the results were remarkable, while others did not respond at all. In view of the high cost of the treatment and also the danger of late reactions, this treatment method should be employed with great caution and only in selected cases.

ERNST A. POHLE, M.D., Ph.D.

THE ESOPHAGUS (DIAGNOSIS)

Esophageal Varicosities or Carcinoma? Klaus Pohlandt. Röntgenpraxis, Oct. 1, 1931, III, 889-895.

The roentgenologic differential diagnosis between a carcinoma and varicosities of the esophagus is sometimes very difficult. Multiple small filling defects may be present in both, the only differentiation of importance being the slight narrowing and fixation of a cancer as compared with varicosities. An esophagoscopy does not always settle the question, as is shown in a case described. Absence of normal elasticity and involvement of only a small portion of the esophagus are points tending to indicate a malignant growth.

H. W. HEFKE, M.D.

Symposium on Esophagus: Diverticula. Frank H. Lahey. Laryngoscope, January, 1932, XLII, 71-75.

A. C. Crump began his discussion with interesting statistics on the incidence of the common types of pathologic conditions found in the esophagus.

"On a combined admission of about 500,000 cases in 10 years in the Presbyterian and Bellevue Hospitals, there were only 665 cases of disease of this organ; a little over 0.2 per cent. Of these, over 50 per cent were carcinoma; cardiospasm, 4 per cent; stricture, 7 per cent, and diverticula, 3 per cent."

In examination of the esophagus, he believes that a fluoroscopic study should precede any instrumentation. He does not state, however, if he thinks the ordinary liquid barium mixture is satisfactory or if gelatin-barium bougies should be used in conjunction.

Crump closed his discussion with the presentation of a case of cardiospasm in a herniated stomach and doubted if "X-ray control" of the dilating instrument was helpful, even in normal stomachs, since the cardia is very variable and can be moved as much as four inches.

HILLYER RUDISILL, JR., M.D.

Preventricular Dilatation of the Esophagus (Luschka), and the Process of Emptying the Esophagus. L. Huismans. München. med. Wchnschr., Aug. 28, 1931, LXXVIII, 1488, 1489.

Luschka, in his publication, in 1857, distinguished between the antrum cardiacum below the diaphragm, and a dilatation above the diaphragm. Lechtenstern reported a case and the author of the present paper adds another, in which a noticeable dilatation of the distal end of the esophagus was found. The author also discusses the physiology and the function of the esophagus.

E. A. MAY, M.D.

Roentgenologic Diagnosis of Lesions in Esophagus. A. P. Overgaard. Nebraska St. Med. Jour., September, 1931, XVI, 350-352.

The roentgen ray with barium meal is the most important procedure in diagnosing diverticula of the esophagus. They are usually located on the lateral or posterior wall of the tube. They are rare at the

lower end of the esophagus, and when found there are usually on the anterior wall and may be mistaken for partial herniation of the stomach. In addition to diverticula, deviations and deformities due to neoplasms are usually capable of early diagnosis. Late diagnosis and ineffective treatment of cancer of the esophagus are a reproach to the medical profession. Herniation of the stomach through the diaphragm often passes undiscovered. and when this occurs through the esophageal orifice, roentgen-ray study is of the utmost importance. Examination in the horizontal position is necessary to detect this lesion, but it is usually necessary to examine in the erect, supine, and oblique positions.

W. W. WATKINS, M.D.

Partial Pharyngeal Paresis as a Roentgenologic Symptom in Diseases of the Esophagus. G. v. Pannewitz. Fortschr. a. d. Geb. d. Röntgenstr., August, 1931, XLIV, 170-177.

On fluoroscopic examination of the diseased esophagus, the author found residues of contrast medium in the valeculæ epiglotticæ and the sinus piriformis in 38.5 per cent of the cases. This observation was made chiefly in cases of esophageal carcinoma. A paralysis of pharyngeal muscular elements must be considered responsible for the phenomenon. In its presence a particularly careful search of the entire esophagus and chest is indicated, as it was never found without the presence of important pathology. Its absence, of course, does not rule out the existence of esophageal disease.

(*Abstractor's Note.*—The closer the lesion is located to the pharynx the more regularly the disease appears to occur.)

HANS A. JARRE, M.D.

Peptic Ulcer of the Esophagus. J. Richards Aurelius. Am. Jour. Roentgenol. and Rad. Ther., November, 1931, XXVI, 696-703.

Peptic ulcer of the esophagus is a definite disease entity, despite the paucity of case reports in the literature. Until recently the lesion was found and reported only at postmortem examinations, but with recent improvements in esophagoscopic examinations clinical diagnoses are being proved, although there is still very little in the literature concerning the roentgenologic diagnosis.

The cardinal symptoms are pain, usually near the lower end of the sternum, dysphagia, nausea and vomiting, and occasionally hemorrhage. These are most apt to be confused, therefore, with high-lying gastric ulcers. The lesion usually involves the lower third of the esophagus and is observed oftenest in middle age, the two sexes showing about equal frequency of involvement. The most significant roentgenologic finding is the niche, with secondary signs of regional spasm and lagging of the barium mixture also being often seen.

The case herein reported was of a white male, aged 40, who had had symptoms of a burning pain in the epigastrium for a period of three years prior to examination. The diagnosis was suggested by repeated roentgen study which revealed the stomach, duodenum, and gall bladder to be normal, but showed a suggestive niche shadow near the cardia. Esophagoscopic examination confirmed the diagnosis, and repeated topical applications of 5 per cent silver nitrate through the esophagoscope for a period of two months were followed by apparent cure. Peptic ulcer of the esophagus requires differentiation from other types of ulcer, such differentiation being most largely dependent on the history of the case.

J. E. HABBE, M.D.

EXPERIMENTAL STUDIES

Radiobiologic Studies on Fertilized Sea-urchin Eggs. H. and M. Langendorff. Strahlentherapie, Nov. 14, 1931, XLII, 793-799.

The authors studied the radiosensitivity of sea-urchin eggs at different stages of mitosis. At intervals of five minutes following impregnation 200 r were applied. There was a maximum at five minutes, a minimum at thirty-five minutes, and a second maximum at fifty-five minutes. Fractional doses of 2×100 r were given at five and thirty-five minutes, thirty-five and fifty-five minutes, and nothing and fifty-five minutes after impregnation. The results confirmed the author's expectations; the mitotic stage influences also the effect of fractional exposure. The ovum is the least susceptible to irradiation during the metaphase, but very susceptible before and after that stage.

ERNST A. POHLE, M.D., Ph.D.

Experimental Study in the Biological Effect of Roentgen Rays. I. Effect of Roentgen Rays on the Blood Constituents of Splanchnicotomized or Vagotomized Dogs. II. The Mechanism of the Decreased Blood Sugar Caused by Roentgen Rays. Shôji Kikuchi. Tôhoku Jour. Exp. Med., 1931, XVII, 545-578.

Irradiation of dogs causes an increased blood sugar (from 25 to 50 per cent) reaching a maximum in from three to seven hours. The size of the dose and the site are comparatively unimportant. The serum *p*H does not change. The serum protein is variably affected, but, like the total N, usually shows an initial increase. If the liver area is irradiated,

there is a very large increase in total N. The blood non-protein N usually shows either no increase or a slight increase; but if the liver area is irradiated, there is a very significant rise. Serum Cl decreases, the extent varying with the amount of irradiation. An initial decrease in the inorganic P is followed by a marked increase. The acetone bodies increase only if the liver area is irradiated, and then in proportion to the size of the dose. A slight increase in lactic acid is followed by a decrease. All these values return to normal within twenty-four hours. Following splanchnicotomy, irradiation causes a decreased blood sugar, and does not affect lactic acid or the total acetone bodies. Vagotomy does not appreciably change the effects of irradiation. The significance of these findings is discussed.

Lymph taken from the thoracic duct of irradiated dogs and injected into rabbits does not affect the blood sugar. If the dog's splanchnics had been sectioned before irradiation, his lymph caused a marked fall in blood sugar. Presumably, irradiation stimulates the parasympathetics in such animals, releasing pancreatic hormone into the lymph and thence into the blood, explaining the fall in blood sugar observed after the irradiation of splanchnicotomized animals.

CHEMICAL ABSTRACTS.

Mice as Indicators of the Presence of Carcinogenic Noxa in Factories. O. Teutschlaender. Deutsche med. Wchnschr., Dec. 19, 1930, LVI, 2166, 2167. (Reprinted from "Cancer Review" by permission.)

A wild grey mouse which was caught in a briquette factory was found to have spontaneous tar cancer, probably produced by pitch dust. This leads the author to suggest that since mice are more susceptible than men to various carcinogenic substances, they might be usefully employed as test subjects in various workshops, also in the so-called cancer houses, for carcinogenic noxa (tar, aniline dyes, X-rays, etc.).

F. CAVERS, D.Sc.

Influence of Radiation Energy on the Mineral Elements of the Blood. St. Malczynski, A. Borysiewicz, and T. Toczyski. Compt. rend. Soc. de biol., Oct. 12, 1931, CVIII, 165-167.

The experiments were made on healthy dogs submitted to ultra-violet radiation from a quartz lamp, to the administration of ergosterin, irradiated by a quartz lamp, and to X-rays.

The results were that under the influence of ultra-violet radiation there was an increase of almost all the mineral elements, especially calcium and phosphorus, and to a lesser degree potassium and sodium.

The alterations resulting from X-rays were much less characteristic, especially regarding those of phosphorus, potassium, and sodium. The authors have observed a general tendency towards a lowering of these elements; for calcium, this lowering was more distinct and quite characteristic.

The effects of irradiated ergosterin were more or less similar to those of the quartz lamp, the differences consisting in greater intensity and longer duration from the quartz lamp. The effects produced by irradiated ergosterin rapidly subsided, the initial values very soon returning on the discontinuance of its administration.

The authors believe their experiments prove that ultra-violet radiation and irradiated ergosterin are stimulants, whereas X-rays have a rather slowing effect on the mineral metabolism of the healthy animal.

HENRY BAYON, M.D.

Experimental Investigations Concerning the Roentgenologic Demonstrability of Pulmonary Connective Tissue. Oskar Meller and B. Menkes. Fortschr. a. d. Geb. d. Röntgenstr., August, 1931, XLIV, 197-204.

This is a very instructive and important paper based on the application of modern conceptions of colloidal chemistry upon our teachings of inflammation. The lungs of young children were removed from the corpses and permitted to hydrate in 5 per cent acetic acid solution. They were roentgenographed and equally inflated under identical technical conditions. There was a marked increase in pulmonary markings during the stage of hydration. It is evident that we will have to pay more attention to the mesodermic pulmonary structures in roentgenologic interpretation.

Further studies on the effects of hydration and dehydration of colloids under the influence of H and HO ions are very important for our conceptions of inflammation and its effects.

Literature may be found under the names of Bechtold, Schade, Menschel, and Roessle. Very interesting and instructive illustrations accompany this article.

HANS A. JARRE, M.D.

Comparative Study of the Action of X-rays on the Adult Thymus and on the Embryonic Thymus. A.-P. Dustin and Ch. Grégoire. Compt. rend. Soc. de biol., Sept. 18, 1931, CVII, 1565-1567.

During experiments undertaken with an altogether different purpose, in which pregnant guinea pigs were irradiated, the authors' attention was attracted by reactions of the embryonic thymus, suggesting

the investigation, not as yet undertaken, of modifications of the thymus to X-rays in the different phases of its histogenesis.

In pregnant females, the thymus presents a state of involution which increases with the age of the animal and as the pregnancy advances. The involuted thymus is sclerosed, poor in thymocytes, containing none but old thymocytes because the process of regeneration is retarded, consequently such organs are but slightly affected by radiation. Pyknosis being sluggish, consecutive phagocytosis is inactive; the thymus reacts under such conditions very much in the manner of the medullary region (more radioresistant) of the normal thymus.

In the fetus, pyknotic degeneration is rapid and massive under the influence of radiation and appears only in the fetus in which the thymus has undergone pseudo-lymphoid transformation. Before this stage the thymic cells are no more sensitive than the surrounding tissues. When, on the contrary, the small thymic cell is developed, it at once acquires a decided hypersensitivity to radiation.

The effects of radiation on the appearance of Hassall's corpuscles is described, the guinea pig being particularly favorable to demonstrate the relations of these corpuscles to the fibro-vascular trabeculæ; their paravascular origin is evident. After radiation they develop all along the vascular framework, even in the cortical substance, undergoing considerable hyperplasia, this being a typical example of the interrelation between thymocytic involution and the evolution of Hassall's corpuscles.

HENRY BAYON, M.D.

THE EYE (DIAGNOSIS)

Report of Small Tumor of the Iris which caused Secondary Glaucoma; Microscopic Examination; Remarks on the Relation of Melanoma to Sarcoma of the Iris. A. Knapp. Trans. Amer. Ophthalmol. Soc., 1930, XXVIII, 118-125. (Reprinted from "Cancer Review" by permission.)

This tumor, a sarcoma, occurred in a man, 30 years of age, who had for about nine years complained of a brown spot on the right iris between three and five o'clock and had noticed dimming of vision for a few weeks before examination. The anterior chamber was deep; pupil 8 mm. in diameter and immobile, and the intra-ocular pressure was 42 mm. Hg. Trephining was done, but a year later the brown mass had become larger, malignancy was diagnosed, and the eye removed.

F. CAVERS, D.Sc.

Large Osteoma of the Orbit. J. N. Roy. Ann. d'Ocul., October, 1930, CLXVII, 825-832. (Reprinted from "Cancer Review" by permission.)

The tumor was a typical simple osteoma with the usual clinical and X-ray features, but the report is of interest because despite the large size of the mass, which involved the floor of the frontal sinus and was associated with marked exophthalmos, fixation of the eye, and diplopia, its removal was effected without interference with the eyeball and with restoration of normal vision. The patient had prudently slept with the eye bandaged, hence there was no corneal ulceration such as frequently results in such cases from inability to close the lids.

F. CAVERS, D.Sc.

THE EYE (THERAPY)

Primary Sarcoma of the Iris Removed by Iridectomy; No Recurrence in Three and a Half Years. W. Zentmayer. Trans. Am. Ophthalmol. Soc., 1930, XXVIII, 109-115. (Reprinted from "Cancer Review" by permission.)

The patient, a boy 10 years of age, had a tumor, first noticed four months previously—which was a swelling 5 × 3 mm. on the pupillary margin of the iris and translucent on a slit-lamp examination. On removal the tumor proved to be a spindle-celled sarcoma with no definite intercellular substance and with blood-vessels lined only by endothelium. Postoperative X-ray treatment was given five times, in all 175 per cent of an erythema dose.

F. CAVERS, D.Sc.

X-ray Treatment of Retinal Glioma. E. Janson. Klin. Monatsbl. f. Augenh., October, 1930, LXXXV, 542-546. (Reprinted from "Cancer Review" by permission.)

In a one-year-old girl the left eye was enucleated on account of retino-blastoma, histologically verified. Six months later a tumor was observed in the macular region of the right eye. Intensive X-ray treatment (6 series, total dosage about 900 per cent H.E.D.) was followed by arrest of the tumor growth, but later this continued, followed by perforation of the eyeball and finally death.

F. CAVERS, D.Sc.

GALL BLADDER (NORMAL AND PATHOLOGIC)

Primary Carcinomas of the Gall Bladder. A. R. Salmon. Jour. Méd. franç., August, 1930, XIX, 280-286. (Reprinted from "Cancer Review" by permission.)

These tumors, which occur most frequently in women between 50 and 70 years of age, are practical-

ly always associated with calculi (11 out of the 12 cases here reported). The author distinguishes four clinical forms, which may, however, occur in combination: (1) Tumor palpable; emaciation, asthenia, dyspepsia, fever, pain; death usually from suppurative cholangitis or rupture of gall bladder and peritonitis; (2) icteric form, having, as the first and most prominent symptom, jaundice due to infection or obstruction; difficult to differentiate from carcinoma of the head of the pancreas; laparotomy frequently necessary for correct diagnosis; (3) dyspeptic form, in which gastric symptoms are prominent, while those pointing to gall-bladder disease are slight or even absent, hence early diagnosis is usually impossible: (4) pseudolithiasis; here the lesion simulates gall-stone disease with biliary colic, and the rapid course is the chief feature in diagnosis of cancer. In some cases X-ray examination is useful for diagnosis. The prognosis is so bad that treatment is limited to relief of symptoms; indeed the chief treatment is prophylactic, *i.e.*, removal of the gall bladder in all cases of gallstones.

F. Cavers, D.Sc.

A New Roentgenologic Symptom of Gallstones. Béla Breuer. Röntgenpraxis, Oct. 1, 1931, III, 879-881.

If the gall bladder does not fill with the cholecystographic contrast medium and if one sees star-shaped shadows, gallstones can be diagnosed with certainty. The star-shaped shadows correspond with cavities in the stones, a fact which is known to pathologists. A case is described in which the flat film showed this type of shadow, which could be seen also when the stones were roentgenographed after operation.

H. W. Hefke, M.D.

The Filling of the Gall Bladder by Contrast Material from the Stomach. A. M. Rybak. Röntgenpraxis, Sept. 15, 1931, III, 844-848.

The filling of the gall bladder by barium (and consequently also by food) which comes from the stomach or duodenum, does not lead to any disturbances or ascending infection of the bile ducts. The roentgenologic examination of patients after a cholecystogastrostomy or cholecystoduodenostomy is of importance for the determination of advantages and disadvantages of the several different surgical procedures. At the time, one may determine the changes in the stomach and duodenum which have taken place after the anastomosis. If there is a suspicion of a spontaneous fistula between the stomach or duodenum and the gall bladder (clinically severe colics which suddenly stop), the possibility of filling the gall bladder with barium must be thought of, the examination being repeated occasionally in one or two hours. Although such an anastomosis has been described frequently by surgeons, the roentgenologic reports of this occurrence are not frequent.

H. W. Hefke, M.D.

The Value of Fast Exposure Following Fluoroscopy in Cholecystography. Ernst Eliasz. Röntgenpraxis, Oct. 1, 1931, III, 874-878.

The technic of cholecystography is of very great importance for a reliable diagnosis. Fluoroscopic examination of a contrast-filled gall bladder, followed by an "instantaneous, aimed exposure," has been neglected. It is this technic which has led to progress in the gastro-intestinal roentgenologic diagnosis. An abnormal projection of the gall bladder, or its obliteration by gas in the intestines, is often very bothersome, especially if the patient lies on his abdomen for the exposure. If the patient's gall bladder is observed in a standing position by use of the fluoroscope, one is almost always able to get the best possible projection. Several cases have been seen, in which a gall-bladder examination of the usual type did not show stones, but the quick, aimed exposure after fluoroscopy demonstrated small stones. The small cone used for this technic serves at the same time for compression.

H. W. Hefke, M.D.

Cholecystographic Studies. Olshausen. Röntgenpraxis, Oct. 1, 1931, III, 865-870.

The author intends to show that, after determining fluoroscopically the position of the gall bladder, a very short exposure with relatively high voltage, no Bucky diaphragm, a small cone (with pressure), and standing position of the patient may give more information about the gall bladder than the usual technic in a prone position. He suggests to look for the gall bladder filled by the contrast material, and if it can be seen, he advises the above technic. If it cannot be seen, he employs the old technic. In case of an overlying gas-filled bowel, the standing position often leads to a successful demonstration of the gall bladder.

H. W. Hefke, M.D.

The Diagnosis of Papillomas of the Gall Bladder by Means of Cholecystography. Hans W. Hefke. Röntgenpraxis, Oct. 1, 1931, III, 871-873.

Only four cases of papilloma of the gall bladder, diagnosed roentgenologically and found at operation, have been reported in the literature (all by Kirklin). Another case is reported, which showed

a filling defect in the midportion of a normal functioning gall bladder. The shape and absence of change of position suggested the roentgenologic diagnosis, which was confirmed at operation and by pathologic examination. The differential diagnosis between stones and newgrowths is touched upon.

THE AUTHOR.

Some Clinical and Experimental Studies on Cholecystography with "Colefanina." Gioacchino Nicolosi. Riv. di radiol. e fisica med., December, 1931, IV, 231-238.

The author reports his experience with oral cholecystography using "colefanina" (tetraiodophthalophenone). Good shadows of the gall bladder were obtained by this drug, which has been found to be perfectly harmless and easy to administer. The results in ten cases are reported.

E. T. LEDDY, M.D.

GASTRO-INTESTINAL TRACT (DIAGNOSIS)

The Skeleton Barium Meal in Gastric Diagnosis. T. D. Overend. British Med. Jour., Nov. 21, 1931, No. 3698, p. 938.

It has long been customary to commence the radiologic examination of the stomach by watching the first mouthful of barium swallowed and looking for a fleck of barium held up in an ulcer niche, if this were present. If this first mouthful is spread over the interior of the stomach by palpation, a good view of the relief pattern of the mucosa is often obtained. But this procedure has its limitations. The ordinary barium meal is not perfectly adapted for the demonstration of the mucosa, and, in spite of the fact that much work has been done on the subject, it may be said that the study of the alimentary mucous membrane has not yet received the attention it deserves. Some of this neglect is due to the incompleteness of our knowledge of the great variations which may occur in the appearances of the normal relief pattern. Nevertheless, the study of the gastric mucosa is by now a valuable supplement to the usual radiologic investigation, and the method of the "thin film" or skeleton meal reveals details that cannot be otherwise discovered.

Technic.—The essential preliminary is the preparation of a solution adapted for adhering to the mucosa. A useful solution is the following: 10 ounces of barium sulphate, 50 grains of tragacanth powder, made up to 20 ounces with chloroform water. The patient is first examined in the supine position with a slight tilt to the left; a sip of the barium is swallowed, and the cardia screened. By palpation and changes of posture the barium is spread over the mucosa and the patient examined in the prone position with graduated compression. Further sips of the barium are given until the mucosa is perfectly covered with the preparation. It is unwise to allow the procedure to become stereotyped; each case has its peculiarities which should be studied individually. The principal sites of ulcer should be screened at every possible angle and examined at different stages of filling. Films are taken when necessary. Graduated compression is required to get good relief patterns, and excessive fluid or mucus in the stomach is prevented by giving 1/100 grain atropin sulphate one hour before the examination.

Normal Appearances.—A constant feature is the presence of four well-marked longitudinal ridges, visible on oblique illumination, running down the lesser curvature; these enclose the stomach path of Aschoff, which is the chief ulcer-bearing area. Towards the greater curvature the longitudinal folds become more and more tortuous, and transverse folds appear. Under normal conditions the relief pattern is delicate and easy to deform or obliterate by palpation; pathologic changes cause it to stiffen, and it then becomes permanent and cannot be altered by pressure.

Chronic Gastritis.—In hypertrophic gastritis the folds of the relief pattern are thickened and stiff; in atrophic gastritis they are very delicate and may be partly absent. Great irregularity and stiffness of the folds favor the diagnosis of gastritis, and a still more trustworthy sign is the presence in the relief pattern of rounded or oval translucent islands due to patches of atrophy.

Although the diagnosis of gastritis by the skeleton meal is by no means easy or free from the possibility of error, there is little doubt but that when its normal appearances are better known it will be found more reliable than any method depending on indirect signs.

Peptic Ulcer.—In the skeleton meal, as in the full meal, the direct evidence is given by the actual niche. The skeleton meal is especially well-adapted for the diagnosis of jejunal and gastro-jejunal ulcer, and also for the differentiation between ulcer and diverticulum.

Carcinoma.—The skeleton meal here finds its application in determining to what extent the growth has penetrated into the stomach walls beyond the actual filling defect, and it may give valuable information as to the mechanical, as apart from the metastatic, possibilities of resection. It is also of value in the diagnosis between chronic callous ulcer and the malignant ulcer.

WALLACE D. MACKENZIE, M.D.

Prolapse of a Gastric Polyp into the Duodenum, with Marked Secondary Anemia. J. W. Hinton and J. Buckstein. Am. Jour. Surg., November, 1930, X, 355-357. (Reprinted from "Cancer Review" by permission.)

An admirably brief and well-illustrated report (including two good photomicrographs) of a case in which a man entered the hospital for relief of anal fistula. He was very anemic and complained of no gastric symptoms. The authors very sagaciously made an X-ray examination after barium filling, and though this showed no gastric lesion it suggested a duodenal tumor. At operation this was confirmed, a stalked gastric polyp of small orange size being found prolapsed into the duodenum.

F. Cavers, D.Sc.

The Roentgenologic Diagnosis of Gastro-enterostomy and Its Complications. Chr. Glockler-Wachramejewa. Vestnic Rentgenologii i Radiologii, 1931, IX, Nos. 2 and 3, p. 143.

The purpose of this work was to determine roentgenologically the form, position, and function of the stomach after gastro-enterostomy and the presence of any post-operative complications. Fifty-eight patients were examined, most of whom complained of some gastric disturbance. Examinations revealed that the form, position, and motility of the stomach vary a great deal. Seldom was the contour of the stomach found to be regular in outline. Adhesions and spasms were frequent complications. In a number of the cases gastric or jejunal ulcers were demonstrated.

The author believes that the position of the gastro-enterostomy is a determining factor in the development of complications. In cases in which the gastro-enterostomy was low, complications were less frequent. The roentgenologic investigation of the stomach is important in order to find out the position and form of the stomach before operation, thus enabling one to determine the most convenient place for the gastro-enterostomy. In case of no improvement the roentgenologic method is the best means of determining the character of the changes which have developed.

Samuel Brown, M.D.

The Clinical Significance of the Roentgenologic Findings of the Stomach and Duodenum. Sidney A. Portis. Illinois Med. Jour., LXI, January, 1932, 19-23.

When there is a definite discrepancy between the clinical and roentgenologic findings, both of them must be repeated and checked very carefully and the group of findings which have the most weight must be taken as the diagnosis. It is to be remembered that the roentgen ray reveals facts subject to clinical interpretation and that the final diagnosis must depend upon a correlation of the roentgen and clinical findings.

High lying lesser curvature lesions are often difficult to diagnose accurately by the X-ray. These occur most often in elderly patients and are usually malignant. Since surgery offers but little relief in such cases, it is best to treat them with deep X-ray therapy, along with proper medical management.

Lesions of the greater curvature are practically always malignant and should be treated as such from the time of their recognition.

Lesions of the antrum are more open to question since this portion of the stomach is so often the site of reflex spasm. Cholecystitis, duodenal ulcer, appendicitis, and other extragastric lesions produce spasm simulating organic gastric lesions.

The clinical significance of duodenal stasis (easily recognized with the fluoroscope) is not sufficiently appreciated. Many lesions, anomalies, and anatomical conditions may produce it.

Charles H. DeWitt, M.D.

Lymphatic Pseudoleukemia of Stomach, with X-ray Film of Hypertrophic Gastric Polyposis. V. Sváb. Med. Klin., Dec. 24, 1930, 1922-1924. (Reprinted from "Cancer Review" by permission.)

A man, 45 years of age, had symptoms suggestive of cholecystitis, while the X-ray film resembled that of hypertrophic polyposis of nearly the whole of the stomach. At operation the stomach wall was found to be greatly thickened, while long continuous folds of hypertrophied mucosa, up to 2 cm. high, ran from cardia to pylorus. The hypertrophied tissue, as also enlarged neighboring glands, presented the picture of aleukemic lymphadenosis; and the blood count showed absence of leukemia.

F. Cavers, D.Sc.

The Roentgenologic Appearance of the Large Duodenal Ulcer. I. G. Brdiczka. Fortschr. a. d. Geb. d. Röntgenstr., August, 1931, XLIV, 177-181.

Duodenal ulcers, exceeding pea- or bean-size, are well known to the pathologist but rather unknown to the roentgenologist, as the literature does not contain any radiologic reference to them. The size of such ulcers is usually given as varying between pepper seed and bean dimensions.

The author reports three cases, confirmed by inspection, of very large duodenal ulcers, exceeding the size of a twenty-five cent piece. They showed on rontgenologic study a symptomatology quite different from those usually attributed to duodenal ulcer and described as follows: The crater, somewhat resembling a normal duodenal bulb, filled suddenly

but did not change its form, except by pouring out its contents with postural changes, according to the more anterior or posterior involvement of the duodenal bulb. These large niches show no peristaltic action and cannot be evacuated by external pressure. Their contours may be entirely smooth. The mucosal structure cannot be differentiated and a relief of mucosal folds concentric to the crater is not to be observed, due to the distention of the residual not involving the mucosal surface. The proximal duodenal knee is shortened and at times so contracted that it may simulate a stenosis.

Instructive illustrations are given, especially those showing a perforated ulcer, burrowing into adjacent tissue and covered over with omentum and gall bladder.

HANS A. JARRE, M.D.

Constipation. G. J. Joubert. Jour. Med. Assn. S. Africa, Oct. 10, 1931, V, 623-628.

The author discusses the problem of constipation from the standpoint of the general practitioner, giving first some of the factors in constipation with especial application to physical and mental types of persons. He states that "Constipation is one of the ailments which follows us through life, beginning in infancy."

The causes of constipation in babies are numerous: (1) Improper feeding of the mother and constipation of the mother; (2) Lack of fat in the milk; (3) Excessive evaporation of the skin; (4) Lack of regular habits; (5) Lack of muscle tone, and (6) Lack of carbohydrates.

Rectification is suggested by the additional feeding of cream or fresh butter. Castor oil or drastic purgatives are not recommended, but enemas are helpful. Fruit juice daily is beneficial, also.

Intestinal stasis in children is common and is often due to wrong diet and habits. A survey of the symptoms is made, and the diet is analyzed in detail. Regular habits are urged.

The surgical aspects of some forms of constipation are emphasized, such as relieving strictures, adhesions, piles, fistulæ, etc.

The complete physical examination with the various tests and special studies are necessary in making the proper diagnosis.

In conclusion the author outlines the aims in the treatment of constipation as follows: (1) Regular bowel movement, with a formed stool; (2) Regular habits of life and food with regular and complete evacuation of the bowels, and (3) Use of a drug or drugs to promote the passage of a formed stool, and which can be used without variation.

MURRAY M. COPELAND, M.D.

Lymphosarcoma of Cecum. F. Belleli. Riforma Med., Sept. 22, 1930, XLVI, 1514-1519. (Reprinted from "Cancer Review" by permission.)

In a man, 22 years of age, who complained only of slight abdominal pain (unrelated to meals), a large fairly mobile mass was felt in the right appendix region. Although no localization was obtained by X-ray study after introduction of barium, operation revealed a large tumor of the cecum. This was resected and found to be a lymphosarcoma; two weeks later death occurred, with symptoms pointing to lung metastases. There was no necropsy.

F. CAVERS, D.Sc.

The Form, Size, and Position of the Cecum. Nicola Lovisatti. Fortschr. a. d. Geb. d. Röntgenstr., August, 1931, XLIV, 181-188.

Observations were made on 2,000 cecal cases. A new classification is given as follows:

1. Funnel-shaped (or fetal).
2. Bag-shaped with bulging appendico-cecal junction in the center of the cecal pouch.
3. Bag-shaped with cylindrical appendico-cecal junction in the center of the cecal pouch.
4. Bag-shaped with bulging appendico-cecal junction located postero-medially and proximally within the cecal pouch.
5. Bag-shaped with cylindrical appendico-cecal junction located postero-medially and proximally within the cecal pouch.

Complete obliteration exists in from 3 to 6 per cent of all adults. Partial obliteration exists in 25 per cent of all adults (according to Ribbert).

The fourth type is found most frequently, from 55 to 60 per cent of all cases. Size and form vary physiologically in wide ranges. Rudimentary ceca, with a capacity of less than 40 c.c., occur occasionally just as macro-ceca containing up to 400 and more centimeters. A mesenterium commune occurs in from 30 to 35 per cent of the cases (according to Frommon and Treres).

The author observed 47 cases in which the cecum was found tilted dorsally and upward, with consequent abnormal insertion of the ileum. An unusually large percentage of these cases showed intestinal distress and pathology.

(*Abstractor's Note.*—Comparison of these observations with the publications of Kantor in this country is suggested.)

HANS A. JARRE, M.D.

Visceral Tetany. Alkan. Arch. d. mal. de l'app. digestif, July, 1931, XXI, 813-820.

In 1922, an epileptic female, 39 years of age, pre-

sented, besides several daily attacks of epilepsy, cramps in the upper abdomen, accompanied by vomiting, which occurred as often as six times daily. In addition, there were symptoms of tetany, particularly Trousseau's phenomenon. Radiology revealed spasm of the antrum only. Within twenty-four hours all spasm had disappeared after injections of paraglandol, an extract of the parathyroid gland.

Carlson and Jacobson produced tetany in nineteen out of twenty-three dogs, after parathyroidectomy, as well as hyperemia and small hemorrhages of the gastro-intestinal mucosa, particularly in the pylorus and the duodenum. Ulcers of variable size were also found in these areas.

Clinical confirmation is found in the report of Falta and Cahn, who, in 1912, reported that ten out of twenty-one cases of idiopathic tetany presented gastro-intestinal spasms and hypersecretion, while three had definite ulcers.

One case is described of a white woman, presenting such symptoms after accidental parathyroidectomy, accompanied by X-ray plates showing spasm of the antrum and pylorus and an ulcer of the antrum.

In 1929, the author published a report of 220 cases showing hypermobility or spasm of the digestive tract, with hypersecretion and with or without ulcers. Of this number, forty-six, or 23 per cent, showed Chvostec's or Trousseau's signs.

The author concludes that these ulcer cases, presenting symptoms and evidence of hypoparathyroid function, are caused by this deficiency. Erosion of the mucosa occurs frequently and is a transient affair, but when this occurs in a mucosa where the mobility is greatly increased and at times exaggerated to such an extent that spasms occur, there takes place a repeated and prolonged anemia around the erosion. Autodigestion by the gastric juice may follow and in this manner a chronic ulcer is formed and persists.

In 148 cases of tetany, he found 66, or 45 per cent, with ulcers. Twenty showed only hypermobility of the antrum. All these cases presented a spasticity of the descending colon, which he believes occurs in all such ulcer cases, due to tetany.

Following the subcutaneous administration of paraglandol and intravenous injections of calcium chloride or bromide, the author had success in three-fourths of these cases, while no results were obtained in ulcers due to other causes. In 65 cases, 54 per cent are well after one year and 31 per cent are well after more than two years. At times parathormone (Collip) was used in very refractive cases. A régime of bland, non-irritating food, without meat, is followed in severe cases. The therapy is favored by the periodicity of the function of the parathyroid gland with its normal summit in spring and autumn. Even in cases apparently well, several injections of calcium are given at the beginning of the perilous seasons.

B. J. DeLaureal, M.D.

GASTRO-INTESTINAL TRACT (THERAPY)

New Research on the Treatment of Gastro-duodenal Ulcers by Parathyroid Extract. François Moutier and Louis Camus. Arch. d. mal. de l'app. digestif, July, 1931, XXI, 834-848.

Since the original publication, in 1929, Hernando Rocha, of Madrid, and Gallart y Mones, of Barcelona, have reported discouraging results, while Max and Erna Lévy have obtained purely negative results from this type of therapy. Statistically, this has no advantages over other forms of treatment. However, the authors still feel that it has its indications. Forty-five cases so treated are analyzed. Eight cases, or 17 per cent, gave absolutely negative results. Of these, three were intolerant of the drug. Twenty cases were improved both as to clinical and radiologic manifestations. Seventeen cases had relapses.

The extract can be given hypodermically or by mouth, the latter method being preferred. Ten units of parathormone Lilly represents 1 c.c. of parathyroidine Byla. Small doses are preferable and in cases in which there is evidence of intolerance, such as vomiting or exacerbation of pains, the drug should be given at an interval of from 2 to 3 days. Hypercalcemia is a contra-indication. This form of therapy can be combined with others, as bismuth-atropine, pepsin, and insulin. No benefit was observed when calcium was added to the treatment. Vagotonia types tolerate the drug better. Often the relief of pain is immediate, at other times following two or three injections. Nocturnal pain disappears first. Occasionally a rapid fall in acidity occurs. The most favorable cases are those without stenosis, periduodenitis, or perigastritis. The blood-calcium content is but slightly affected. Those cases with an acid-base equilibrium tending towards the acid side seem to react most favorably. It is also most effective in the younger individuals.

Observations on four cases show the variations of response to different treatments. Each case responded to one of the following treatments after failure of all the other types mentioned: parathyroid, pepsin, atropine, and insulin.

After five years' study the conclusion is drawn that parathyroid extract has a definite, but irregular and mysterious, action which needs further study.

B. J. DeLaureal, M.D.

Constipation. S. F. Silberbauer. Jour. Med. Assn. S. Africa, Oct. 10, 1931, V, 619-623.

The author defines constipation as "a disturbance of intestinal function, usually of the colon, which results in delayed or incomplete evacuation of the

bowel." Normally, the residue of a meal should be evacuated within 48 hours, a delay of 72 hours may be considered pathological. The physiology of intestinal movements and the act of defecation are discussed. About 350 gm. of semifluid chyme are said to pass the ileocecal valve daily, and about 135 gm. of feces are passed daily.

The etiology of constipation is discussed and the causes, according to Kast, are listed as follows:

(1) Mechanical obstacles, due to: *(a)* external pressure from abdominal or pelvic tumors, *(b)* invaginations, volvulus, kinks from adhesions, *(c)* stenosis of intestines from ulcers, etc.; (2) Dyschesia (fissure, hemorrhoids, etc., inhibiting reflex); (3) Inhibiting influences such as spinal disease, abdominal inflammations, endocrine dysfunctions, psychic depressions; (4) Functional derangements, such as toxic disturbances, tone of intestinal musculature, abnormal lack of stimulation; (5) Essential constipation.

The author considers dyschesia as the most common type. Essential constipation is considered to be due partly to defect in mechanism of peristalsis and to endocrine defects.

Under "Clinical Investigations," the author states that sufficient information is often obtained from an ordinary history and clinical examination. Examination of the anus and rectal examination prevent many errors. Other adjuncts to the physical examination are proctoscopic examination, chemical and microscopic examination. An X-ray of the gastro-intestinal tract often gives a clue to the origin of the constipation.

The symptoms and effects of constipation are discussed under the head of headaches, vertigo, insomnia, and fatigue. Digestive disturbances are not infrequent, including flatulence, abdominal discomfort, and offensive breath. Gastritis and duodenal catarrh may supervene. Palpitation, dyspnea and low blood pressure are sometimes noted.

The author discusses the treatment of constipation at length, the essentials of which are: (1) Correct diagnosis; (2) strengthening and educating the bowel; (3) removing the cause where indicated and possible (appendix, etc.); (4) regard for diet, and (5) combinations of dietetic, local, and drug treatment.

The diet of the atonic case should contain large quantities of cellulose, increasing the bulk of stools. The spastic constipation case should have food which leaves as little residue as possible.

Enemas are suggested as relief and are discussed in detail. Among the drugs which are mentioned agar agar and mineral oil are considered as important. The vegetable drugs are recorded with dosage and effects on bowel. Salines by mouth are emphasized in certain types of cases. "Mercurial purgatives should be reserved for special occasions," the author states. They do not have action on the flow of bile. Opium is often used in combination, with cases of colitis.

Some foods have laxative effects (brown sugar, honey, sour milk).

Hormones are discussed. Thyroid extract is considered helpful in cases of sub-thyroid individuals.

The surgical aspects of constipation are not dealt with.

MURRAY M. COPELAND, M.D.

The Diagnosis and the Cure in Gastroduodenal Ulcers, Clinically, Radiologically and by the Gastroscope. François Moutier. Arch. d. mal. de l'app. digestif, July, 1931, XXI, 821-832.

There are few questions so delicate to approach as the interpretation of the cure of gastroduodenal ulcers, in spite of the numerous publications of new methods of treatment and rapid cures following each method.

Clinically, the disappearance of pain, hematemesis, melena, and vomiting signifies nothing. It means simply the disappearance of the paroxysm. Anatomically, these ulcers, it is true, may heal rapidly, even in a few weeks, with cicatrization. Many relapse after weeks, months, or years. The intermediate silence does not signify cicatrization. They have, therefore, an evolution, intermittent and spontaneous. Absolute negative clinical or radiologic findings may be observed between attacks, although in general, untreated cases seldom present longer absence of symptoms than one year, while treated cases have been known to have time intervals of over two years. Some cases may have ulcers arising in other areas, following the original involvement.

Radiologically, the disappearance of the niche does not mean a cure. The image seen often represents an ulcer plus something else. Many flat ulcers present such a niche and the actual measurement of the ulcer may vary considerably from that of the X-ray image. Another factor to be explained is the disappearance of this niche sometimes in two or three days or longer. Agreeing with Schindler, Gutzeit, Haudek, Forssell, Berg, and Albrecht that inflammatory and dynamic conditions are present, there are still other factors in evidence. Besides the edema of the borders of the ulcer and inflammatory interstitial reaction, there is a swelling of the adjacent folds, forming around it a pouch and even excluding the ulcer from the gastric cavity in the form of diverticula. Dynamically varying spasms or contractions are present, or are seen by the gastroscope. Such may be like a diaphragm, a purse, or a buccal contraction, forming a separate cavity at the bottom of which lies the ulcer. A film so viewed gives the image of a semicircle which in reality is a trough-like depression. Relief of the surrounding inflammation and spasm is followed by

a disappearance of the niche, any new muscular excitation causing its reappearance. This, of course, holds true for only gastric cases. Occasionally the image of a cavity can be seen without, or in an area away from, an ulcer.

In old and callous ulcers, the X-ray cavity may represent its true size, and its disappearance may signify healing. Also, it is possible that the fibrinous exudative covering may be brushed off and followed by a reappearance of the niche.

These facts have been established from endoscopic studies. Here ulcers were found which caused no X-ray shadows; others which were very flat but which caused a shadow; still others which were detached from the general gastric cavity by spasm. Gastroscopy and gastrophotography allow one to watch the progress of healing after the X-ray findings are negative, following the suppression of spasm.

A silence of at least two years and possibly three should elapse before one can consider an ulcer cured.

B. J. DeLaureal, M.D.

GENITO-URINARY TRACT (DIAGNOSIS)

Recent Advances in Diagnostic Methods in Renal Affections. R. Ogier Ward. British Med. Jour., Aug. 1, 1931, No. 3682, pp. 175-177.

The first diagnosis of stone by X-rays was made in 1896. Then, in 1906, Voelcker and Von Lichtenberg established instrumental pyelography as a diagnostic method. Von Lichtenberg has now developed excretion urography to its present high efficiency by the use of the pyridine derivative, uroselectan, first produced by Binz and Raeth. Many other chemical compounds have been tried, but the latest and most successful is D. 40, better known as Uroselectan B. It is another pyridine derivative containing 51 per cent iodine as compared with the 42 per cent in its predecessor. It has been produced by the same chemists and tested in Von Lichtenberg's clinic. It is interesting to note that a large amount of iodine is not essential, as only 15 grams of Uroselectan B are used for each injection, compared with 40 grams of the original uroselectan. The special success of Uroselectan B is due chiefly to the fact that the kidneys eliminate it very promptly (a quarter of an hour) in the urine in high concentration and with a diuresis which is just sufficient to cause it to flow through the urinary tract in an intensity suitable for X-ray work.

The *technic of injection* is as follows: Uroselectan B is sold as sterile solution in 20 c.c. ampules which contain 15 grams of iodine compound, the dose used for adults. The solution is warmed to body temperature and injected intravenously with a 20 c.c. syringe. There is no need to inject the solution slowly.

Contra-indications and precautions: Uroselectan B produces no discomfort and is entirely non-toxic. Uremia, either present or impending, is the chief contra-indication and, therefore, a routine blood urea and kidney function test is necessary to exclude this. If any serious general illness co-exists, special caution should be exercised. Due to the inefficiency of the kidneys, the liver undertakes in part, at least, the excretion of the drug; therefore, liver disease is a contra-indication. In acute inflammation of the urinary tract excretion urography must be avoided. Iodine idiosyncrasy rarely manifests itself.

One of the most interesting results brought about by this new method of investigation is the fresh light shed upon the neuromuscular mechanisms of the urinary tract. Therefore, it will help us much in the study of the pathology and treatment of hydronephrosis. This disease is the result of a defect in this mechanism; the law which governs the working of a system of unstriped muscle has broken down, contraction ocurs in one segment but no relaxation in the segment below, probably owing to the disturbance of sympathetic control. A pyelogram demonstrates clearly a hydronephrosis. Excretion urography sometimes shows the same hydronephrosis but of considerably larger size. This is because in the latter case the kidney has filled the pelvis at a rate to which it is accustomed, whereas in instrumental pyelography the opaque fluid has been run in through the ureteric catheter much more rapidly, and the pelvis has resisted the process. This gives us a clear proof that, though damaged, the pelvic neuromuscular mechanism is not destroyed; and this is an encouragement to the surgeon who wishes to perform upon it a plastic operation.

There are certain conditions in which excretion urography is of special value for other reasons, namely, when it is undesirable or impossible to pass the cystoscope, as, for example, in the presence of a urethral stricture or an enlarged prostate, or severe cystitis. And, again, in circumstances preventing the passage of a ureteric catheter, such as ureteric kink, or a ureteric calculus.

Wallace D. Mackenzie, M.D.

Mistakes and Pitfalls in the Examination and Treatment of Diseases of the Uropoietic System. Eduard Pflaumer. München. med. Wchnschr., Sept. 25, 1931, LXXVIII, 1654-1657.

This article is written for the general practitioner as well as for the specialist. It illuminates the subject from every angle, not in the least from that of the X-ray specialist. The most important technical mistakes are those of incomplete photography of all uropoietic organs and of unsatisfactory plates.

Over-exposures lead to false diagnoses. On the other hand, a perfect film without evidence of the shadow of a stone is not proof of the non-existence of a stone, as 30 per cent of stones do not cast shadows. Phleboliths often mislead one as to the diagnosis of stones in the ureter, a point which can be easily decided by taking another film in another plane. The use of contrast fluids, by either the descending or ascending method, offers also many pitfalls in the diagnosis. The filling defect in uroselectan films is not as valuable for the diagnosis of tumor as that of contrast filling on a pyelogram. Uroselectan is useless for diagnosis of stones, and still more problematical is it in the functional diagnosis. Only an expert can interpret these films. The same holds true in the diagnosis of pathologic conditions of the ureters in pyelograms. Diagnoses of enlargement of the pelvis of the kidney, and stenosis or kinks of the ureter are made far too frequently.

E. A. May, M.D.

The Diagnosis of Ureteral Calculi and the Problem of Their Conservative Management. Albert M. Crance. Am. Jour. Surg., January, 1932, XV, 120-129.

A series of seventy-seven cases of ureteral calculi is reported, in which three, or 3.89 per cent, required ureterolithotomy, two are still unpassed, and seventy-two, or 92.5 per cent were passed successfully without open operation. In this series, it is interesting to note that fifty-seven, or 74 per cent, showed rather definite roentgenographic shadows of the calculi prior to the filling of the ureter with an opaque solution. The X-ray technic in ureteral stones must be most carefully considered. One must study his roentgenographic findings with great care. Many calculi are missed by too quickly passing a negative opinion on a film in which the stone shadow may be discovered later.

Diagnostic importance is made of the clinical history, the presence of red blood cells in the urine, and the cystoscopic and X-ray technic combined. Cystoscopy is planned, preferably while there is still renal tenderness present. The ureteral catheter or bougie is more apt to meet obstruction at this time, at the point where the stone is lodged. The finding of pelvic retention by syringe test is also of importance at such a time.

If a catheter is passed after the relief of colic, it may occasionally go beyond a stone without the slightest sense of obstruction. However, the technic of passing a catheter should be carried out slowly and cautiously. Rapidity in reaching the renal pelvis loses all the fineness of touch and sensation. If one catheter has passed up successfully, then, and not until then, is an exposure made on a 14×17 inch film, using, of course, a Potter-Bucky diaphragm. The operator may then attempt to pass another No. 5 catheter. In a few instances, a second catheter has met obstruction at the stone, but in most cases two have been admitted successfully. The X-ray film should then be studied by the operator. If a shadow is demonstrable, one of the two catheters is plugged and a urogram made; however, this is not always necessary. The degree of hydronephrosis can often be ascertained by withdrawing the residual pelvic urine by means of a syringe. If no shadow is found and there is no reason to suspect a stone, the catheter is removed and replaced with a larger Garceau or Woodruff catheter for the purpose of urography. Filling defects, bulging in the ureteral wall, plus the previous findings of red cells, may be regarded as indicative of ureteral calculi.

A diagnosis having been made, two No. 5's are again passed up beyond the stone. No doubt there are some who will say, "Supposing the stone cannot be passed; will the ureter allow a catheter?" Then a heavy No. 8 or 9 olive-tipped bougie usually will pass. If one then attempts to introduce a catheter immediately after the removal of a bougie, it will almost always pass. It may be necessary to draw it back and forth a few times, which, incidentally, has been of great value.

The patient is then returned to his room in a recumbent position, and the catheters left in place for twenty-four, forty-eight, or even seventy-two hours. As the catheters are about to be withdrawn, one is plugged (if two are in) and a 30 c.c. Luer syringe is filled with sterile water and connected to the catheter. The kidney is filled slightly beyond the point when the patients feels the renal pressure. The catheter is very slowly withdrawn with one hand, while the syringe is held for injection in the other hand. Two forces are at work with this procedure: the traction caused by the downward motion of the catheter, plus the force from above, which in many instances accomplishes the desired purpose. Frequently, by this procedure, patients have passed calculi within forty-eight hours after the removal of the ureteral catheters, and in most instances without any additional, or so-called "final colic." This method of removing the ureteral catheters during irrigation has resulted rather successfully in a rather high percentage of cases.

The use of ureteral spirals, forceps, rubber-bags, etc., has in no way added to the successful management of this series.

No mortalities occurred in this series.

Several interesting plates of ureteral calculi accompany the article.

Davis H. Pardoll, M.D.

Urethrography with Abrodil as Contrast Fluid. B. H. U. Mohrmann and Heinz Strauss. München. med. Wchnschr., Oct. 2, 1931, LXXVIII, 1700-1702.

The injection of contrast fluids in the male urethra for X-ray diagnosis has been done since 1910. It can be used in cases of acute gonorrhea, and shows, by means of the X-ray, early as well as advanced strictures. It demonstrates the condition of the urethra beyond the stricture, also diverticular abscess cavities and injuries. It is ideal as a follow-up examination, the technic being simple. From 20 to 50 c.c. of abrodil are injected into the urethra. The patient lies on his back in a semi-oblique position, with the penis parallel to the leg.

E. A. May, M.D.

Excretion Pyelography (Urography) by Means of Subcutaneous Abrodil Infusion. O. Butzengeiger. Röntgenpraxis, Oct. 1, 1931, III, 881-884.

Excretion pyelography has proved itself a very valuable diagnostic means, being often the only possible means for a roentgenologic diagnosis of kidney diseases. Intravenous injection of the contrast material has been the only means of getting a good pyelogram. It is, however, not always technically easy and even occasionally impossible (children, fat persons). The author has endeavored to present a subcutaneous method of introducing the abrodil (skiodan in the United States). In association with Hecht, the discoverer of abrodil, the method was worked out. A 4 per cent sterile abrodil solution, which is practically isotonic, is used and two ampules of impletol (a combination of caffeine and novocaine) are added. If 20 gm. of abrodil are to be used, 500 c.c. of this solution are injected subcutaneously between the breast and axilla.

After using this method in thirty cases the author came to the following conclusions: The best roentgenograms are obtained from 30 to 50 minutes after completing the injection, but good roentgenograms are still given from 1 to 2 hours afterwards. Skin damage or necroses were not observed. No general reaction took place. In a few cases some slight pain was complained of during the injection. In all thirty cases the demonstration of the urinary tract was satisfactory. This method seems indicated especially in children.

Hans W. Hefke, M.D.

GENITO-URINARY TRACT (THERAPY)

Transplantation of Ureters to Rectosigmoid and Cystectomy for Exstrophy of Bladder: Report of Seventy-six Cases. Waltman Walters. Am. Jour. Surg., January, 1932, XV, 15-22.

The results obtained in transplantation of ureters to the rectosigmoid and removal of the exstrophied bladder in a group of seventy-six patients operated on at the Mayo Clinic are reported. The method of transplantations was first used by C. H. Mayo in February, 1912; he applied Coffey's principle of submucous duct transplantation to the ureter. The operative procedures have been divided into three stages: (1) Transplantation of the right ureter into the rectosigmoid; (2) two weeks later transplantation of the left ureter, and (3) ten days later removal of the exstrophied bladder. In none of these cases were ureteral catheters used in the transplantation. Three patients died in the hospital subsequent to operation. Twenty-seven patients have lived five years since the operation, and thirteen have lived ten years. Results were unsatisfactory in only three cases. In 50 per cent of the cases there was no evidence of renal infection. In 21 per cent there were short periods of mild renal infection, the interval between such periods in most cases being many months, sometimes years. The infection, too, was mild and apparently had little effect on the patient. The use of compounds such as uroselectan, or skiodan, intravenously, has made possible the study of renal function as well as of the outline of the renal pelvis and ureter in many of these cases. The use of this method and other methods of study of renal function leads to the belief that renal function is normal and that there is no dilatation of the pelvis, calices, or ureters in cases in which the ureterosigmoidal transplantation is accurately carried out.

Several uretero pyelograms taken before and after operation for exstrophy of the bladder accompany the article.

Davis H. Pardoll, M.D.

Ureter Catheter Drainage in Ureterotomy. W. M. Kearns and S. M. Turkeltaub. Am. Jour. Surg., January, 1932, XV, 56-60.

The author presents a case record which demonstrates the consequences of omitting catheter drainage. The indwelling catheter has a distinct place in ureteral surgery because it insures kidney drainage, eliminates fistula and urinary extravasation by diverting the stream, promotes prompt healing, and prevents stricture formation. It may also act as a prophylactic against suppression of urine.

In the case cited by the writers, attempts to pass a ureteral catheter at operation, following ureterolithotomy, were unsuccessful. The rubber drain was removed from the ureteral bed twenty-four hours following operation. This early removal was carried out with the hope that the urine would make its way through the lower ureter promptly instead of through the fistula, thus obviating ureteral obliteration. The urine continued to extravasate and the fistulous tract closed, with the development of symptoms of sepsis, urinary absorption, and anuria. Blood transfusion overcame the anuria in a phenomenal

way. The symptoms of sepsis and urinary absorption were miraculously relieved by the passage of a ureteral catheter.

Several roentgenograms illustrative of calculus in the ureter and extravasation of the pyelographic media accompany the article.

DAVIS H. PARDOLL, M.D.

Endothelioma of Penis: Urethrography. W. Dobrzaniecki. Jour. d'Urol., April, 1930, XXIX, 368-377. (Reprinted from "Cancer Review" by permission.)

In a man 59 years of age, complaining of burning pain on micturition, examination showed escape of somewhat purulent liquid on compressing the penile urethra, infiltration of glans, slight soft enlargement of inguinal glands, and a hard, enlarged prostate. Tumor was suspected and its site accurately determined by urethrography, using a contrast material 100 c.c. of barium suspension mixed with 10 c.c. of 2 per cent collargol solution. The penis was amputated in its upper third and the inguinal glands dissected out. The microscopic diagnosis was hemangio-endothelioma. There was no sign of recurrence when seen four months later.

F. CAVERS, D.Sc.

GYNECOLOGY AND OBSTETRICS

Anatomic Changes Subsequent to the Radiotherapeutic Treatment of Benign Uterine Conditions. James A. Corscaden. Am. Jour. Obst. and Gynecol., July, 1931, XXII, 74-86.

The author analyzes 434 cases with reference to the effect of irradiation on the size of the myomatous uterus; the importance of X-ray and radium as excitants of latent infections; the frequency and importance of subsequent changes within the tumor, such as degeneration and sarcoma; the occurrence of carcinoma of the body and neck of the uterus and disease of the tubes and ovaries, especially those conditions which were overlooked at the time the treatment was given and later became apparent.

In the literature, considerable emphasis is placed upon the danger of exciting quiescent foci of infection by radium and X-ray. Many such cases are reported, but the precise lesion is less often described. The author, a gynecologist, and presumably impartial toward irradiation, concluded that the cause of inflammation following the introduction of radium was due to an operative contamination rather than to some less obvious effect of the electromagnetic waves upon either the tissues or bacteria in a residual inflammatory focus. In fact, several cases in which there was definite inflammation showed improvement following roentgenotherapy. Polak and Bal, who have had similar experiences, employ the X-ray as a therapeutic measure in the management of acute pelvic inflammatory disease.

In all patients treated for uterine myomas, the growth was stopped, reduction has occurred to a satisfactory degree in 83 per cent, and there has been complete reduction of the mass to the size of a normal uterus in 55.2 per cent.

The author, basing his statement on the government mortality statistics, states that 2.4 per cent of women in general develop carcinoma of the uterus. Only 1.28 per cent of his cases treated for fibromyomas subsequently developed carcinoma of the uterus, observations having been over a period of seven years.

The evidence permits the author to conclude that the incidence of diseases in the organs of reproduction of women after treatment by X-ray and radium is a little less than in women in general. The occurrence of uterine bleeding and discovery of a small myoma does not make one a candidate for promiscuous prophylactic excision. With the growth stopped and the uterus made smaller by X-ray or radium, she has the same chance for health as the women without these conditions.

The importance of a diagnostic curettage is emphasized. The author encountered unexpected pathology (carcinoma of the body of the uterus, epithelioma of the cervix, pedunculated intra-uterine myomas, polyp) in 3 per cent of his cases, which caused a change in the method of treatment.

JACOB H. VASTINE, M.D.

Myoma of the Uterus. E. Vogt. München. med. Wchnschr., Sept. 4, 1931, Vol. 78, No. 36, pp. 1525-1529. Also issue of Sept. 11, 1931, 1562-1565.

The author deals with symptomatology and diagnosis minutely. He compiles the different types of treatment and gives the indications for each, which do not, in any way, deviate from the methods used in this country.

E. A. MAY, M.D.

Significant Problems for the Obstetrician in the Field of Mammary Cancer. B. J. Lee. Am. Jour. Obst. and Gynec., December, 1930, XX, 775-781. (Reprinted from "Cancer Review" by permission.)

Out of 306 cases of breast cancer in women under 40 years of age eleven were pregnant. The longest period of survival after operation was five years and ten months. In such cases the pregnancy should be terminated, the radical breast operation done directly afterwards, and the patient advised to undergo

ovarian sterilization by high-voltage X-rays, or if not consenting to this measure, to avoid further pregnancy. In fourteen of these 306 patients, the breast cancer co-existed with the puerperium, and the results of operation were not much better in this group. Out of 1,827 patients seen at the Memorial Hospital with breast cancer, eleven had a malignant tumor of the genital organs (cervical cancer; corporeal cancer, 4; vulva and ovary one each).

F. Cavers, D.Sc.

Actinotherapy in Gynecology. José Luis Molinarí. Rev. Med. Cubana, November, 1931, XLII, 1338-1358.

In this article the author not only discusses actinotherapy as it applies to gynecology but gives complete and comprehensive information on the entire subject of actinotherapy. At the beginning of the article he limits his discussion to ultra-violet ray therapy, leaving the discussion of infra-red rays for a future date.

After defining the terms which will be used, the author goes on to describe the place occupied by the ultra-violet rays in the spectrum. This is followed by the list of physical and chemical properties of these rays. After describing the Herz-Hallwacks' phenomenon, the intensity of the rays is taken up. He points out the various intensities which will produce different physiologic changes. Using different Ångströms, diverse physiologic reactions are produced. In this connection the author makes mention of the results obtained by Nogier and d'Hasselbach and Macht and Bells.

The discussion continues with the physiologic and biophysic reaction produced by the ultra-violet rays. In this connection we may list some of the most important: bactericidal action and metabolic action on calcium, phosphorus, sulphur, sodium chloride, and the general action on protoplasm. In the consideration of the action of ultra-violet rays on the human organism the author takes up the effect on the integument. Erythema, being the most important, is taken up first. The author presents Finsen's conclusions, which are as follows: (1) The thermic rays produce only a temporary erythema lasting about two hours; (2) ultra-violet rays produce an erythema which is late in appearing but lasts long; (3) the rays next to the ultra-violet rays also produce an erythema but it is less lasting.

In the author's opinion most physiotherapists prefer to use from 2,970 to 2,800 Ångströms to produce an erythema. Using this amount, the erythema appears in from four to six hours, this naturally varying with the cutaneous sensibility of the various body regions. According to Hill, Elinart, Kisch, and Sobodka, erythema is produced more quickly and to a more intense degree when the integument has been heated previously. The erythema varies with the individual, age, and certain diseases, such as asthma, adenopathies, hepatitis, and hyperthyroidism.

The duration of the erythema varies from forty-eight hours to a week. The redness changes to violet and later to maroon. This is a sign of the beginning of pigmentation, the mechanism of which is not exactly known at present. Turning to physiologic chemistry for information one has to consider the skin as a gland as well as a protective covering. Chemical analysis has shown that there are various diastases present in the skin. The following have been isolated: amylase, lipase, catalase, phosphatase, sulphatase, carboxylase, oxidase, a peptolytic ferment, and tyrosin ferment. Thus, it is reasonable to assume that through oxidation and reduction processes on the diastases, ultra-violet rays cause pigmentation. Keratotic changes of the skin take place when the pigmentation disappears; however, these changes occur simultaneously with pigmentation but independent from it. According to the studies of Lederle, Pautrier, Magnus, Müller, etc., the following take place: (1) The most superficial layers of the skin show intracellular and intercellular edema. (2) The blood vessels in the dermis are engorged and show a lymphocytic infiltration.

The author here gives a complete report of the ultra-violet rays on the following organs and tissues: the eye, blood, nervous system, spleen, suprarenals, thyroid, ovaries, and bones. He continues by giving a discussion of the various theories on the general action of ultra-violet rays. Of these the following workers and their theories are mentioned: Christen (1917-1919), S. Rothmann (1924, 1925), and Rohler. The two theories best recognized are those of Keller and Guillaume. Keller believes that the reactions produced by ultra-violet rays are due to a toxic effect caused by the reabsorption of by-products, which are the results of the irradiation. Guillaume takes up Keller's theory and adds more detail to it. Vignal, on the other hand, does not accept either theory because neither one is based on chemistry, physics, or biology. He thinks that the changes are produced by oxidation reduction processes.

In discussing the artificial supply of ultra-violet rays, the author mentions the voltaic arc, the mercury lamp, and the specially named lamps, such as Walter's and Landeker's.

For the determination of ultra-violet dosis many methods have been proposed, the most important of which are enumerated.

(1) *Photothermic.*—This is based on the transformation of light into heat. The apparatus used is the "pireliómetro" of Pouillet and the "pilatermoeléctrica" of Melloni.

(2) *Photochemical.*—This is based on the chemical actions of the ultra-violet rays. Keller's apparatus is used for this measurement.

(3) *Photo-electric.*—If light falls on a film immersed in a conducting liquid, a current is produced

which goes over to another film kept in darkness. The apparatus of Mallet and Cliquet is used.

Since the skin sensibility varies with the individual, it is best to determine this sensibility, using either Keller's or Saidman's apparatus. With the latter apparatus one can determine the various stages of erythema from its formation to its hemorrhagic stage.

In the discussion of gynecologic conditions the treatment is taken up in anatomic order from the outer to the inner structures.

Affections of the Vulva.—Schlein thinks that actinotherapy is of no value in the treatment of pruritus. Using the technic of Aimard and Dausset, that is, local and general applications of ultra-violet rays, giving an erythema dose from time to time, good results are obtained. A local erythema dose is given two or three times a week. If necessary, small doses of X-ray are given. The above named authors have obtained good results using the technic outlined. In fact, they report improvement even in difficult cases, having given them twelve applications. The use of the high frequency current has also given favorable results. Other vulvar conditions treated successfully are: eczema, fissures, vulvitis, and kraurosis (using the X-ray). Fissures due to bartholinitis heal very quickly under ultra-violet-ray treatment.

Vaginal Affections.—Wagner began the treatment of vaginitis in 1913. Later, Lang reported good results. The latter gives his results in the treatment of both children and adults. The therapy consists of both local and general irradiation. He begins with exposures of five minutes each.

Cervical Lesions.—Non-cancerous lesions of the cervix respond remarkably well to ultra-violet irradiation. Wagner, Van de Velde, and Mateucci have obtained satisfactory results with six exposures. In cases of cervical discharge ultra-violet irradiation has proved of inestimable value. Complete cures have been obtained in 51.3 per cent of the cases. Using the Landeker lamp, applications may be given for as long as thirty minutes at a time. Complete cures have been obtained with from three to eight applications. Even the chronic cervical lesions have responded to this treatment. The lesions due to inflammatory causes respond quicker than those due to other causes.

Lesions of the Corpus Uteri.—Wagner thinks that ultra-violet-ray treatment will control uterine hemorrhage due to fibroids. In sclerosis of the corpus uteri, Francillon-Lobre and Palisse have obtained good results. Landeker has obtained 60 per cent cures in chronic endometritis. Casati, Viana, and Mateucci also report satisfactory results. Local applications are given by means of the speculum of Ferguson or by a quartz lamp applicator in doses of from six to ten minutes' duration.

Lesions of the adnexa and parametritis have also been treated with good results. Pyosalpinx has been treated by a combination of abdominal and general ultra-violet irradiation. The parametritis cases have required long applications but even cases due to gonococcal infection have subsided. Inflammatory masses, especially those due to gonococcal origin, have responded remarkably well to ultra-violet treatment. Those reporting cases of this nature give 70 per cent cures. Salpingitis also responds with the same favorable results.

In the treatment of ovarian disorders ultra-violet rays have demonstrated the following: That (1) menstruation is stimulated in the young; (2) the menstrual flow is regulated, and (3) the menopause is retarded.

Hypoplasia.—Landeker has reported ten cases of delayed ovarian function due to congenital deformity which improved under ultra-violet irradiation. In the treatment of ovarian disorders as amenorrhea, the condition shows quick improvement. This is especially true of those cases due to ovarian insufficiency. The ultra-violet rays have no direct action on the uterus but accelerate the ovarian tissue. Aimard and Dausset give local and general irradiation using both sunlight and ultra-violet light. After twenty exposures most cases show improvement. Dysmenorrhea and oligomenorrhea respond to ultra-violet treatment by improvement of the condition. Scanty menstruation is improved and dysmenorrhea is practically corrected. In cases of premature menopause, especially those due to X-ray exposures, satisfactory results are obtained. The symptoms of menopause disappear, and the patient feels relieved. The internal ovarian secretion is accelerated under ultra-violet irradiation. These internal secretions stimulate the secondary sexual characteristics.

Genital Hemorrhage.—Ultra-violet irradiation is particularly indicated in the following: (1) Juvenile hemorrhages; (2) pre-climacteric and climacteric hemorrhages, and (3) hemorrhages due to secondary anemias.

Genital Tuberculosis Including the Adnexa and Peritoneum.—In treating genital tuberculosis, one aims to give the patient a supportive treatment as well as to produce a local hyperemia. The technic used is as follows: (1) Gradual increase of doses of sunlight treatment; (2) local ultra-violet irradiation combined with sunlight exposures; (3) general increase of ultra-violet irradiations; (4) abdominal applications of ultra-violet rays from time to time, and (5) combination of ultra-violet and X-ray therapy.

Most of the cases with ascites show improvement. Those cases having perivisceritis or pericolitis show an acceleration of the symptoms. On the whole the majority of cases of genital tuberculosis shows improvement.

Ultra-violet rays in gynecology give the following: (1) A local action, as in dermatology, on eczema. abscess, etc.; (2) a general action, especially on

tuberculosis and anemia, and (3) a direct action on the ovary.

JOSEPH MALDONADO, M.D.

Unusual Tumor of the Nipple. E. Fischel and L. H. Jorstad. Am. Jour. Surg., January, 1931, XI, 121-124. (Reprinted from "Cancer Review" by permission.)

The patient, a woman of 27 years, said she had had a wart on the nipple for seven years, which had not been influenced by electrodesiccation or X-ray treatment. The growth was reddish brown and measured 3 × 2 millimeters. The nipple and the surrounding normal areolar tissue were excised and examined microscopically, good photomicrographs being given. The chief features of the lesion are hyperplasia and keratosis of the epithelium, with inflammatory changes in the surrounding tissue. It seems to be an atypical early Paget lesion.

F. CAVERS, D.Sc.

Radio-active Modifications in Ovarian Insufficiency. Iribarne. Bruxelles-Méd., Sept. 13, 1931, XII, 1336, 1337.

After presenting new ideas concerning ovarian insufficiency and its different clinical types, together with results of his own experience, the author is convinced of the stimulating action of radio-active substances on cellular activity, especially when small doses are employed. Parallel experiments have been made on the germination of seeds and the growth of vegetables and animals.

In the organism, radium has a very complete action on account of its affinity for certain tissues.

Numerous clinical observations have convinced the author of the beneficial influence of radio-active therapy on ovarian insufficiency. Association of opotherapy is recommended. This double treatment is particularly indicated in ovarian insufficiency of puberty. The nervous symptoms and menstrual pains are favorably influenced.

HENRY BAYON, M.D.

The X-ray Treatment of Uterine Hemorrhage and Uterine Fibroids. L. J. Carter. Canadian Med. Assn. Jour., November, 1931, XXV, 582-584.

This paper is the tenth in the series of papers being contributed by members of the Canadian Radiological Society in the educational campaign. It is being conducted for the purpose of familiarizing the general profession with the accomplishments of physio-therapeutic methods in diagnosis and treatment.

In this article the hope is expressed that through the publication of this and other articles in the *Canadian Medical Association Journal,* every family physician in Canada may become familiarized with the benefits which the radiotherapist can confer by X-ray treatment of aggravated and persistent hemorrhage of the menopause. One hundred consecutive cases of uterine hemorrhage and uterine fibroid were reported before the Radiological Society of North America as having received X-ray treatment. All were cured, with the exception of three which proved to be malignant, while in these three the X-ray treatment was a good preliminary measure to the subsequent use of radium and surgery. Similar uniformly good results are reported by all X-ray workers who have published their results.

Emphasis is laid on the fact that the treatment should be carried out only by a radiotherapist who is devoting all of his time to radiology. "For the physician who is only occasionally operating an X-ray machine to attempt the X-ray treatment of uterine hemorrhage is hazardous in the extreme. Over-dosage will precipitate a type of menopause that will be extremely stormy both for the patient and the family physician, while under-dosage will probably only aggravate the hemorrhagic condition." The referring physician should, however, be in a position to give the patient some information concerning the amount of time required to complete the treatment. This would usually consist of three series of treatments one month apart, each series occupying from three to six days, according to the condition of the patient and the particular type of treatment employed. Further, the referring physician should warn the patient that there may be an exacerbation of the hemorrhage following the first series of treatments. Failure to give this warning may make subsequent explanations difficult.

The writer regards as contra-indications to the X-ray treatment of uterine hemorrhage the following: Excessive size of a fibroid tumor, subserous pedunculated fibroid, a large incarcerated fibroid giving rise to urgent pressure symptoms, a submucous fibroid that bleeds subsequent to a course of treatments. Malignancy is a contra-indication for the use of the X-ray alone, to the exclusion of radium and surgery. Pelvic inflammatory conditions are not contra-indications but rather the reverse, providing a pus tube or some other pus pocket is not present, requiring evacuation by surgical methods. The striking results secured in the X-ray treatment of boils and carbuncles find an analogy in the magic disappearance of pelvic inflammations after a course of X-ray therapy.

The X-ray treatment of uterine hemorrhage in women during the child-bearing period should generally be avoided. There is experimental evidence which indicates that the germ cell may be so modified by irradiation as to establish hereditary abnormalities, not in the immediate offspring but in descendants one or more generations removed.

The *modus operandi* of the X-ray in the arrest-

ing of uterine hemorrhage and the reduction of uterine fibroids is generally regarded as being a combination of a number of actions.

Radiation is essentially a destructive process, involving the disappearance of the immature rapidly growing fibroid cell and its replacement by fibrous tissue. There is also an endarteritis which shuts off the blood supply of the growing tumor or bleeding uterus; also a direct action on the ovary. The Graafian follicle is either destroyed or undergoes cystic degeneration. The corpus lutea and the internal secretion of the ovary are depressed but not destroyed when the proper dosage is administered. The artificial menopause induced by X-ray does not differ in kind or severity of symptoms from the normal climacteric.

HEART AND VASCULAR SYSTEM (DIAGNOSIS)

A Case of Aneurysma Dissecans of the Thoracic Aorta. Robert Kienböck and Konrad Weiss. Fortschr. a. d. Geb. d. Röntgenstr., August, 1931, XLIV, 211-214.

Retrospectively, an intrathoracic lesion, originally merely reported as an aortic aneurysm with some unusual features, was assumed to be an aneurysma dissecans. It is believed that this diagnosis may occasionally be made *in vivo* in the presence of a dense shadow (nucleus) within a relatively transparent and unusually formed aneurysmatic picture.

HANS A. JARRE, M.D.

New Facts Concerning the Question of Orthocardiography. J. I. Arcoussky. Vestnic Rentgenologii i Radiologii, 1931, IX, Nos. 2 and 3, p. 133.

The author presents a full discussion of orthodiagraphy of the heart and aorta. He consider orthocardiography to be a very valuable roentgenologic method of investigation, but as it is now practised, the method is not adapted to clinical study. His modifications make the method of greater usefulness in clinical medicine. Upon the basis of his investigations and measurements of the heart, he succeeded orthodiagraphically in proving that the volume of the heart increases at the moment of inspiration.

SAMUEL BROWN, M.D.

Persistence of the Right-sided Aortic Arch, Demonstrated Radiologically. Klaus Mardersteig. Fortschr. a. d. Geb. d. Röntgenstr., August, 1931, XLIV, 163-169.

This is a case report. By careful roentgenologic examination suspected specific aortitis could be ruled out. A persistent right-sided aortic arch was found associated with a congenital ventricular septal deficiency. The esophagus and trachea were considerably displaced by a persistent left-sided aortic root (knob), resembling an aortic diverticulum.

For literature on this subject see Biedermann: *Fortschritte auf dem Gebiete der Röntgenstrahlen*, 1931, XLIII, 168.

HANS A. JARRE, M.D.

HERNIA

Retroperitoneal Parajejunal Hernias or Hernias of Treitz and of Waldeyer. Georges Brohée. Arch. d. mal. de l'app. digestif., July, 1931, XXI, 794-812.

The depressions described by Treitz and Waldeyer are parajejunal on the right and left sides, not paraduodenal. They are three in number: right, left superior and inferior. The various theories of development are described and found to be insufficient.

Rarely retroperitoneal hernias may develop at these points. About 175 have been reported, about 30 of which were on the right side. Four clinical types are recognized: the insidious, the type due to diarrhea, to constipation, and the acute or subacute occlusive type. Vague digestive disturbances, resisting all medication, mesogastric pain radiating to the left, tumefaction to the left of the vertebral column in the umbilical region are all strong presumptive signs. The radiologic findings are not fixed. The diagnosis is seldom made pre-operatively and the prognosis is that of all abdominal hernias.

Treatment depends on circumstances: in the occlusive or strangulated type, if the strangulated area does not preserve its vitality, débridement is recommended; in other types, a reduction of the hernia followed by an obliteration of the orifice, directly or indirectly, is the treatment of choice.

B. J. DE LAUREAL, M.D.

HODGKIN'S DISEASE (DIAGNOSIS)

Roentgenologic Study of Intrathoracic Lymphoblastoma. B. R. Kirklin and Hans W. Hefke. Am. Jour. Roentgenol. and Rad. Ther., November, 1931, XXVI, 681-690.

The authors studied and analzed the intrathoracic roentgenologic findings in sixty-seven cases of lymphoblastomas, these being sub-classified by clinical and microscopic findings as Hodgkin's disease (forty cases), lymphosarcoma (seventeen cases), and leukemia (ten cases). X-ray changes in the chest were

seen oftener (50 per cent) in cases of Hodgkin's disease than in cases of lymphosarcoma or leukemia (20 per cent).

The proven cases of Hodgkin's disease were divided into two groups, the larger group comprising 62 per cent of the cases showing mediastinal and hilar node changes only, the smaller groups of 30 per cent showing involvement of the pulmonary tissue, either infiltrative or metastatic, with or without node involvement. The most commonly seen changes in the cases of Hodgkin's disease consisted of multiple well-defined discrete rounded or oval shadows in one or both hilar regions, with a more or less lobulated superior mediastinal shadow. The cases with lung involvement showed a much more variable picture, some resembling the patches of bronchopneumonia, one resembling extensive bronchiectases, and several simulating primary or metastatic pulmonary neoplasm.

The seventeen cases of lymphosarcomas all showed either mediastinal or hilar node involvement, or both. The majority of the cases showed bilateral, lobulated mediastinal widening. Four of the seventeen cases revealed pulmonary involvement also. The appearances of the ten cases of leukemia showing intrathoracic involvement were not appreciably different from the cases of lymphosarcoma. Four cases of leukemia showed pulmonary as well as node involvement.

The authors conclude that there is no absolutely characteristic difference in the roentgenologic appearance of these closely allied malignant lymphomas. Differentiation from aneurysm, benign tumors, substernal goiter, carcinomatous and sarcomatous metastases, primary carcinoma of the lung or bronchus, pulmonary tuberculosis, Pott's abscess, marked dilatation of the esophagus, and mediastinitis must be made.

J. E. Habbe, M.D.

THE KIDNEY

Pyelographic Evidence of Horseshoe Kidney: Report of a Case in a Girl Thirteen Years of Age. Samuel J. Sinkoe. Am. Jour. Surg., January, 1932, XV, 51-55.

A correct pre-operative diagnosis of horseshoe kidney is not a simple matter, and it is only on the operating table or in the autopsy room that we are able to confirm our diagnosis. There are, however, certain clinical facts in addition to our pyelographic findings which may justify one in arriving at a tentative diagnosis, and should any surgical emergency arise in a patient suspected of having this congenital anomaly, the surgeon should be on guard and proper measures should be carried out accordingly. The anomalous rotation of the renal pelvis, the unusual location of the calyces, the finding of the renal shadow lying close to the vertebral column, the abnormal insertion and shortening of the ureter, the visibility of the presence of an isthmus, all point to a definite renal abnormality, and that abnormality suggests a horseshoe kidney. Clinically, the presence of Rovsing's sign may be of great value. One must also remember that horseshoe kidney is more liable to infection than a normal kidney, and may be subject to various diseases, such as stone, tuberculosis, pyonephrosis, etc. One must, therefore, be on guard for suggestive symptoms and treat the condition accordingly.

In conclusion, the author emphasizes the fact that in congenital anomaly of the kidney, especially of the horseshoe variety, stasis and infection are usually present and proper therapy depends upon carrying out ureteral dilatation and pelvic lavage in order to alleviate the patient's symptoms.

The writer has included a brief review of the literature on this subject, together with detailed accounts of a case reported by D. N. Eisendrath and one of his own. Interesting pyelo-ureterograms accompany the article.

The importance of a thorough urologic investigation of individuals with a persistent pyuria is emphasized.

Davis H. Pardoll, M.D.

Nephroptosis: Its Diagnosis and Treatment. Jay J. Crane. Calif. and West. Med., September, 1931, XXXV, 201-204.

The author discusses surgical fixation of the kidney as practised before the modern methods of diagnosis were used, noting particularly that many times there was failure to relieve the symptoms. To-day he does not advise anchoring every floating kidney, and, therefore, limits himself in this line to those kidneys in which urinary stasis is found, with the aid of the cystoscope and X-ray.

Under the heading of symptoms he notes that he has come to rely on the X-ray findings for the position, rather than on palpation of the kidney. He divides the kidney mobility into three degrees, namely: First degree, when the pelvis rests opposite the third lumbar vertebra; second degree, when the pelvis rests opposite the fourth lumbar vertebra, and third degree, when the pelvis rests opposite the fifth lumbar vertebra.

Diagnosis is made by the subjective symptoms and the findings, sometimes by palpation, plus the objective evidence of pathology as demonstrated with the X-ray and cystoscope and the reproduction of the pain by injection of pyelographic fluid. The surgical treatment is also discussed.

Francis B. Sheldon, M.D.

Solitary Cyst of the Kidney: Report of Two Cases. Joseph A. Lazarus. Urol. and Cutan. Rev., November, 1931, XXXV, 698-703.

In the seventeenth century, Fabry, of Hilden, a famous German surgeon, and the noted English internist, Thomas Willis, made some interesting observations on renal cysts. The first precise remarks concerning cystic renal disease are to be found in Rayer's treatise on disease of the kidneys, published in 1837. In 1867, Laveran, in his monograph, distinguished between solitary renal cysts and polycystic disease of the kidneys.

A solitary cyst of the kidney is a typically benign cyst, usually of considerable size, and situated, as a rule, in one pole of the kidney. It may be designated as "serous" if its contents are clear and watery, or "hemorrhagic" if they are bloody. The serous cyst, which is the more commonly observed, is lined with an epithelial layer of flat or low cuboid cells. As a rule, there is no communication between the cyst and the kidney pelvis. Numerous theories regarding the pathogenesis of solitary cysts have been offered, but the preponderance of evidence thus far adduced seems to favor the theory that solitary renal cysts are congenital and bear a close relationship to polycystic renal degeneration. There is, likewise, a great variance of opinion regarding the site of origin of such cysts.

This condition gives rise to no pathognomonic symptoms. The cyst is accidentally discovered at autopsy, or during an exploratory operation in some cases. Pain of a dull and dragging character is present in many cases. Pressure upon neighboring organs may give rise to symptoms in those organs. Hematuria has been reported in only two cases.

The author believes that a tentative diagnosis can be made by a careful reading of the plain roentgenogram. In this condition the X-ray will reveal a globular enlargement of one of the renal poles of lighter density than the remainder of the renal shadow, or a notching of the convex border of the kidney at its point of attachment to the cyst. A distinct line of demarcation between the cyst and the kidney may be seen in some cases. In cysts of the lower pole a medial deviation of the opaque ureteral catheter may also occur. According to Braasch, pyelography shows a shortening of adjacent calices, a flattening of the portion of the pelvis in contact with the cyst, and a change in the axis of the kidney, due to the weight of the cyst. While, as a rule, the pyelographic findings in solitary cyst are distinct from those of tumor of the kidney, in certain cases the differential diagnosis of the two conditions is impossible. Palpation usually reveals an enlarged renal mass.

The treatment of solitary cysts of the kidney is surgical. In cases with good functioning renal parenchyma, the cyst is completely removed with the entire lining. Following extirpation of the cyst the kidney should be suspended. In those cases in which the cyst is in intimate contact with the renal pedicle, nephrectomy must be done.

The author reports two cases illustrating the points mentioned by him to be observed in diagnosis and treatment. The first case was that of a woman, 63 years of age, who presented a solitary serous cyst, involving the lower pole of the right kidney. The pre-operative diagnosis was made from the plain roentgenogram, and nephrectomy was performed. The second case was that of a woman, 53 years of age, with involvement of the lower pole of the left kidney. A tentative pre-operative diagnosis of solitary cyst was made from the plain roentgenogram. Owing to the finding of blood in the specimen obtained from that kidney, tumor could not be ruled out prior to operation. Partial nephrectomy was performed in this case.

J. N. Ané, M.D.

LIGHT THERAPY

On the Photochemical Decomposition of Hemoglobin and the Relations of the Reaction to Chlorophyl. G. Kögel. Strahlentherapie, Oct. 3, 1931, XLII, 379-383.

On the Acceleration of the Reduction of Methylene Blue by Proteins under the Influence of Light. G. Kögel. Strahlentherapie, Oct. 3, 1931, XLII, 384, 385.

In the first article the author relates his experience with the effects of light on chlorophyl solutions under the influence of sensitizing substances. Hemoglobin and its derivatives were also studied. It appeared that the sulphydryl group was most effective in the splitting up of hemoglobin.

In the second paper the effect of several amino acids on the reduction of methylene blue were investigated. Leucine, alanine, and glycocoll seem to be most active.

Ernst A. Pohle, M.D., Ph.D.

The X-ray as a Complement to Actinotherapy. Sir Howard Humphris. Canadian Med. Assn. Jour., September, 1931, XXV, 311-314.

As radiography should not be considered an entity in diagnosis but kept in correlation with other methods of diagnosis, there seems to be reasonable grounds for assuming that the X-ray can be used as a valuable adjunct to the rays of the spectrum not far removed from it. Especially is this true of ac-

tinotherapy, since the space between X-rays and ultra-violet has been bridged spectroscopically by Millikan and Holweck.

As instances of diseases in which the X-rays and actinotherapy may supplement the action, the one of the other, the author quotes from the work of Bayliss and Sampson. The former states: "The effect of the X-rays on cells is similar to that of ultra-violet light. Their lethal effect, however, continues for a long period." Sampson says: "In lupus vulgaris, often after the first few actinic-ray treatments, a dermatitis dose of X-rays is of the greatest utility." Again in psoriasis some of the more recent areas cleared up promptly under actinotherapy, but some of the older and more indurated regions were intractable until the ionizing X-ray dose was given.

Even as they may be used together clinically, X-rays sometimes, not indiscriminately however, may be given when there is dermatitis from ultra-violet radiation. When the ultra-violet radiation is given to increase skin tolerance the reaction should be allowed to die down before administering the X-rays. In lupus vulgaris, in cases in which it is desirable to produce extreme dermatitis, the best results are obtained by superimposing the X-rays upon the ultra-violet dermatitis.

In considering team work betwen X-ray and ultra-violet radiation, let us recall the way in which the former produces its therapeutic effects:

1. The endothelial lining of the blood vessels becomes edematous, this edema eventually occluding the artery and cutting off the nutrition of the growth, and resulting, if the treatment is pushed to that extent, in an obliterating endarteritis in the capillaries.

2. X-rays appear to have special action on new cells and on elementary embryonic tissue. Here the nucleus becomes cloudy, the nuclear membrane disappears, and then is carried away by the process of phagocytosis, and replaced by connective tissue in those cases in which the treatment is prolonged.

These and other changes that are brought about greatly depend upon the blood condition of the patient. We have seen that ultra-violet rays are actually absorbed by the capillaries, and cause chemical changes in the composition of the blood. This consideration may explain the mechanism by which are brought about the good effects of the combined use of the two measures.

The problem of the successful use of the combined measures of X-ray and actinotherapy involves, *inter alia,* two main questions. These are the measure of the sensitivity of the pigmented skin to the X-rays, and the possibility that such simultaneous and combined application may be productive of cumulative effect. Researches show that the pigmented skin is not abnormally sensitive to such treatment. Should, however, the skin be exposed to the ultra-violet rays of the quartz lamp, the result is somewhat different. If the ultra-violet rays are found to produce a violent reaction, the effect of the X-rays would be to increase it. Such treatment should, therefore, be reserved for those cases in which previous light treatment has brought about a certain degree of tolerance of the tissues. So far as cumulative action is concerned there is no evidence of any harmful effect from the combination of treatments.

In considering the therapeutic effect of these two agents, it is interesting to contrast their several actions on the skin. Either will produce a dermatitis, but the X-ray one takes weeks, months, or even years to develop, while that from ultra-violet occurs in a few hours. X-ray dermatitis causes baldness, while the ultra-violet stimulates the growth of hair. Atrophic changes may develop from X-ray dermatitis, while the ultra-violet causes little more than desquamation. The irritability of a given area is increased following an X-ray dermatitis, while it is decreased following an ultra-violet dermatitis.

The conjoined employment of X-ray and actinotherapy followed the observation that X-ray dermatitis, if not too severe, yielded readily to the application of the ultra-violet. If, however, cicatricial tissues have formed, these must be softened up by X-ray treatment before the ultra-violet will be effective.

In conclusion, the author regards as definitely proven the facts that X-ray and ultra-violet are mutually complementary methods of treatment. Each has added to the field of usefulness of the other, when used to supplement it, under carefully selected conditions. Up to the present, research has not gone far enough to make it possible to postulate any exact technic for the combined use of the two measures.

L. J. CARTER, M.D.

THE LIVER

Flat Film of the Liver. Arthur Wolf. Röntgenpraxis, Aug. 15, 1931, III, 732-739.

A flat film of the liver, if technically good, gives a considerable amount of information. One is usually able to show the lateral and the lower edge of the liver up to the gall-bladder region. Changes in the shape and size of the liver can usually be demonstrated. In one case, a carcinomatous nodule could be seen on the lateral edge of the liver.

H. W. HEFKE, M.D.

New Methods of Radiologic Visualization of the Liver and Spleen. Carlos B. Udaondo, Eduardo Lanari, Pedro A. Maissa, and Juan C. Galán.

Prensa Méd. Argentina, July 10, 1931, XVIII, 161-166.

The authors present five cases of visualization and follow the method introduced by Radt. They use Tordiol and Heyden 1,073 Ä., giving from 10 to 20 c.c. intravenously daily until a total of from 40 to 80 c.c. have been given. Their results were very good, and they conclude that the method of Radt is a great step in the diagnosis of diseases of the liver. Only one case showed intolerance of the substance as indicated by slight rise in temperature, dizziness, and headaches.

N. G. Gonzalez, M.D.

MASTOID

Radiographic Evidence of Mastoid Pathology. Richard A. Rendich. Med. Times and Long Island Med. Jour., September, 1931, LIX, 319, 320.

The roentgenogram serves as an anatomic as well as a pathologic study of the mastoid. It furnishes information concerning the type and size of the mastoid, its development, size and extension of cells, thickness of the cell walls and mastoid cortex, and the position and course of the lateral sinus and emissary vein. Pathologically, the decrease of aeration indicates the amount of serum, purulent material, or granulation tissue in these cells, structural changes in the septa being shown by changes in density. An abscess of the mastoid is recognized by absence of cell septa in a more or less irregular spherical area of varying size, delimited by a zone of slightly increased density. Sclerotic mastoid is readily distinguished by absence of cells and a dense eburnated triangular area marked posteriorly by the lateral sinus groove. An acute exacerbation of an otitis media will give no X-ray evidence in a mastoid of this sort. The radiograph must show the entire mastoid in the finest detail. It is then a distinct aid in deciding on surgical procedures.

W. W. Watkins, M.D.

MEDICAL PRACTICE

A Radiologist's Duty to His Specialty. Charles M. Richards. Calif. and West Med., June, 1931, XXXIV, 395, 396.

The author criticizes the profession for using the lay laboratory and for oftentimes accepting diagnosis from these laymen. At the same time he condemns the radiologist for not being a true consultant, stating that he has oftentimes not seen the patient or demanded the history or clinical findings to assist him in making his diagnosis, and that he has not stressed the point that the work of the radiologist is after the films are made.

The fact that the practice of radiology is in every sense the practice of medicine should be impressed on our medical confrères, by the conduct of our work both at the hospital and in private practice. In connection with the report of the death of a member of our specialty, the author notes there was used the following significant statement: "He was a physician, practising radiology."

Francis B. Sheldon, M.D.

The Training in Radiology for the Dermatologist. A. Stühmer. Strahlentherapie, Oct. 24, 1931, XLII, 599-604.

The author, who holds the chair of Dermatology at the University of Munster, outlines in this article his opinion concerning the training of specialists in radiology as the dermatologist sees it. In view of our interest in all matters of training regarding our chosen field of endeavor, his conclusions will be related here.

The creation of chairs for general and clinical roentgenology to be occupied by a physician must be demanded. A radiation institute for teaching and research purposes is essential. In such an institute the students should be taught roentgen physics, radiobiology, general clinical roentgenology, as well as biology of light and light therapy. Special courses should be given for clinical assistants in order that their knowledge of roentgenology may be widened. More attention should also be paid to roentgenology in the clinical teaching. It should also become obligatory for the student to pass an examination in radiology.

He says: "The training of physicians using roentgen rays for the treatment of skin diseases should be supervised by the dermatologist." A specialist in radiology should, therefore, not include among his activities the treatment of skin diseases, since that presupposes a complete training in dermatology. If radiation institutes desire to treat skin diseases, such a procedure is acceptable, from the standpoint of the dermatologist, only if he is in complete charge of the case and of the treatment.

Ernst A. Pohle, M.D., Ph.D.

PHYSIOTHERAPY

Hyperpyrexia, a New Field for Physical Therapeutics. Clarence A. Neymann. Brit. Jour. Phys. Med., October, 1931, VI, 141-144.

The author discusses the production of fever with high frequency currents and describes the technic

used in application when the body temperature is to be raised to about 104° Fahrenheit. He states that it usually requires from one and one-half to two hours before 104.5° is reached, but it is very easy to maintain this temperature for periods of from five to eight hours, providing the patient is adequately insulated. A temperature recording device is also described.

The results in the treatment of eighty-five cases of general paresis at the Cook County Psychopathic Hospital, the Elgin State Hospital, and in private practice are enumerated.

In this series, "41 per cent of these patients showed an absolute clinical remission, and returned to their former occupations; 19 per cent made a partial recovery and were able for the most part to adjust themselves outside an institution, and 40 per cent remained unimproved. These results are the more noteworthy since only 34 patients (about 40 per cent) had what we now consider adequate treatment, *i.e.*, at least 100 hours of fever above 103.5° Fahrenheit. . . . . Some have received as many as 50 treatments, with over 200 hours of fever above 103.5°."

The results in tertiary endarteritic syphilis of the brain, Parkinsonian syndromes, and arteriosclerotic conditions do not appear to yield as good results.

The author also states that, "Three years have elapsed since the first cases were discharged from custodial institutions. Thus far not a single case has been recommitted. There seems no mental deterioration in any of the discharged cases of this series, whom we have been able to re-examine from time to time."

WILLIS S. PECK, M.D.

RADIATION

Radiation Therapy of Carcinoma of the Fundus. Iwan v. Büben. Strahlentherapie, Nov. 14, 1931, XLII, 769-774.

During the period from 1919 to 1929, the author observed 101 cases of carcinoma of the fundus. Thirty-eight of these had never had any pregnancy; two were virgins; 14 had one child each, and 49 had had several pregnancies. Forty-five were irradiated and 56 operated on. Histologically, there were 86 patients with adenocarcinoma, 13 with carcinoma solidum, and two with carcinosarcoma. Twenty-eight of the cases operated on could be observed over five years; 12 of these were cured (42.9 per cent). Radium and roentgen rays were used in combination. From 50 to 75 mg. in a silver brass screen, equivalent to 1.0 mm. Pt. were inserted in rubber tubes intra-uterine to give a dose of from 2,400 to 3,600 mg.-hrs. in the uterus and from 2,000 to 2,400 mg.-hrs. in the vaginal wall. Three series of roentgen treatments were given, using from 2 to 6 fields each time, the dose per area being 470 r (measured in air) produced at 183 K.V., 5 ma., 0.5 mm. Zn + 0.5 mm. Al at 30 cm. F.S.D. Examinations of the patients took place first every six weeks, then every three months. Twenty-six patients could be observed for five years; nine remained well less than one year, five remained well for one year, seven for two years, one for three years, one for five years, one for six years, one for seven years, and one for eight years. Four women are considered cured, corresponding to 15.3 per cent.

The author states that the question of radiation therapy of carcinoma of the fundus cannot be considered as a solved problem. However, he feels that the results are so encouraging that further efforts should be made to improve what has been accomplished so far by irradiation.

ERNST A. POHLE, M.D., Ph.D.

Radium Irradiation with and without Filter. George Schapringer. Strahlentherapie, Oct. 3, 1931, XLII, 386-393.

The author analyzes the most common types of radium applicators and their effect on tissue. Expressing the amount of radiant energy emitted as alpha-, beta-, and gamma-rays in calories per hour, he comes to the conclusion that it does not suffice to indicate dosage in milligram-hours. It is necessary to specify the percentage of alpha-, beta-, and gamma-rays affecting the irradiated tissue. He gives some examples illustrating his method.

ERNST A. POHLE, M.D., Ph.D.

Chronic Myelogenous Leukemia: Value of Irradiation and Its Effect on the Duration of Life. William J. Hoffman and Lloyd F. Craver. Jour. Am. Med. Assn., Sept. 19, 1931, XCVII, 836-840.

Since the disease is comparatively rare, its gradual development makes it difficult to determine the exact time of onset.

The average duration of life after the onset of the disease was 3.36 years, and varied from more than sixteen years to as little as six months. Eighty-two cases of myelogenous leukemia are analyzed and compared with a series of 130 cases reported by Minot, Buckman, and Isaacs. The decade of greatest incidence is that between thirty-four and forty-five years. The incidence of the disease increases from infancy to thirty years of age and from that time onward remains practically constant. The youngest patient in their series was fourteen and the oldest sixty-six years. The disease is rare below twenty-five years. In their series 68 per cent were males and 32 per cent were females. Splenomegaly was present in seventy-seven of the eighty-

two patients at the time of diagnosis, indicating that the disease is rarely recognized before this enlargement has developed.

Comparison with Minot's group of non-irradiated patients showed that irradiation actually adds little to the duration of life in this disease. Irradiation early in the course of the disease had no effect on the duration of life. Repeated cycles of irradiation produce remarkable improvement in the condition of patients. The effect, while temporary, lasts from a few months to a year, repetition of the treatment being necessary. The average duration of efficient life after the diagnosis of the disease was 30 per cent greater in their irradiated patients than in Minot's non-irradiated patients. The radiation treatment causes an average increase of about ten months in the duration of efficient life—a period of usefulness that the patient otherwise could not hope to enjoy.

C. G. Sutherland, M.B. (Tor.).

Roentgen Therapy of Carcinoma of the Penis. Juraj Körbler. Strahlentherapie, 1931, XLII, 780-783.

The author describes two cases of carcinoma of the penis treated by roentgen rays with the following technic: 15 H filtered through 0.5 Cu + 1.0 Al given over two areas in two sittings three weeks apart. The inguinal lymph nodes were involved in the first case and were removed by operation. Although the primary tumor responded well to roentgen rays, a recurrence developed in the preputium, and the biopsy showed carcinoma. Amputation was carried out, therefore.

The second case was a student, 23 years old, who had a tumor along the entire circumference at the insertion of the preputium. The inguinal lymph nodes were removed but did not show any involvement. X-ray therapy was started in August, 1927. The tumor responded well, and eight months after the treatment no traces of it could be found. However, the patient developed phimosis and was operated on. Histologic examination of removed tissue did not show any carcinoma. Re-examination was done four years afterwards, and the patient is still well. The author believes that it is worth while to give roentgen therapy a trial in carcinoma of the penis in order to avoid amputation, if possible.

Ernst A. Pohle, M.D., Ph.D.

Roentgenotherapy of Hay Fever. F. E. Haag and H. Schrens. Strahlentherapie, Oct. 24, 1931, XLII, 485-491.

Roentgenotherapy in cases of hay fever is given over the entire nose, using a 0.5 mm. Cu filter, 6 × 8 cm. field, 120 r up to three times every two or three days. No other therapy was applied, in order to obtain correct statistics. Of sixteen cases, six had good results; one temporary improvement; eight did not respond, and one could not be traced. Studies of the skin reactions following a pollen vaccination showed that they run parallel to the clinical symptoms. The reactions during the period of roentgenotherapy were also observed. In some cases the reactions did not appear at all and in others the number and intensity were decreased, while in some there was an increased response.

Ernst A. Pohle, M.D., Ph.D.

Studies on the Effect of the Time Factor in Roentgen Irradiation. R. Glocker, H. Langendorff, and A. Reuss. Strahlentherapie, Sept. 12, 1931, XLII, 148-156.

In this study of the influence of the time factor in irradiation the authors differentiate two stages: First, exposures of such a duration that the velocity of growth of the cell during irradiation can be neglected. It can be expected in such a case that photochemical laws govern the effect of the time factor. Second, exposures which extend over such time intervals that the status of the cell undergoes definite changes. In that case there occur biologic processes which must vary in different objects and cannot be expressed by a general law. Bean seeds and eggs of axolotl were used. It was found that for exposures of short duration (up to one hour for beans, up to one-half hour for eggs of axolotl) the effect of the time factor for intensity changes 1:200 followed Schwartzschild's law. The exponent in this law is 0.96 for beans and 0.95 for eggs of axolotl. A graph is appended which permits the determination of the necessary corrections for the exposure time. If the interval between two fractional doses is varied, then the percentage of injury changes according to the length of the interval. The effect is directly related to the number of mitotic cells present at the time of the second exposure.

Ernst A. Pohle, M.D., Ph.D.

Roentgenotherapy in Non-malignant Disease of the Central Nervous System. Gerd Kohlmann. Strahlentherapie, Oct. 24, 1931, XLII, 453-465.

The author outlines, briefly, the indications and method of treatment in non-malignant diseases of the central nervous system. He begins with inflammatory processes as, for instance, tabes. Twenty-three cases with crisis were treated; fifteen responded well, six moderately well, and two did not respond at all. The technic was as follows: 3 or 4 fields 10 × 15 sq. cm., 30 cm. F.S.D., 180 K.V., 0.5 Cu + 1 mm. Al, from 40 to 50 per cent H.E.D. per field. The entire spinal cord is irradiated, one field every second day. A second series may be

given after from six to seven weeks and a third series after three months. In gastric crisis one can also apply from 20 to 25 per cent H.E.D. to the plexus solaris.

Poliomyelitis can be treated also, particularly in combination with diathermy. The entire spinal cord is treated through 4 fields of entry; acute cases receive from 25 to 30 per cent H.E.D. and in chronic cases 50 per cent of the H.E.D. is given. If only the lower extremities are affected, it suffices to apply 2 fields to the lower part of the spine. Not so favorable are the results in roentgenotherapy of encephalitis. In acute meningitis other methods are much more important. Roentgenotherapy may be given a trial in cases of solitary tuberculosis, particularly if it has been localized by operation. In multiple sclerosis, from 20 to 25 per cent H.E.D. can be given per field. Twelve out of seventeen cases were considerably improved. In cases of chronic headache, relief has also been obtained following the application of from 30 to 35 per cent H.E.D. in two or three series at from six- to eight-week intervals. Cases with traumatic compression and those of meningitis serosa do sometimes respond well to roentgenotherapy. The same holds true of hypersecretion, as, for instance, in patients with liquor fistula. The author has seen good response in epilepsy; it takes, however, many series of treatments and sometimes as long as two years until a definite improvement can be noticed. The technic consists of 50 per cent H.E.D. through 4 fields of entry (9 × 12 sq. cm.). Syringomyelia seems to be very suitable for radiation therapy. The technic of treatment is similar to that in tabes and multiple sclerosis. Raynaud's disease (⅓ H.E.D., three series at from four- to eight-day intervals over the cervical and lumbar spine), torticollis (75 per cent H.E.D., distributed over three successive days), neuralgia (60 per cent H.E.D., over both central and peripheral nerves), and paralysis agitans (20 per cent H.E.D. directed to the fourth ventricle, 5 fields, to be repeated once or twice at from four- to six-week intervals) have also been tried in some cases with success. Reference is made to the work of Wieser, who, for the past several years, has irradiated mongoloid children. In conclusion, it is stated that not enough attention is paid to roentgenotherapy in non-malignant diseases of the central nervous system.

ERNST A. POHLE, M.D., Ph.D.

RADIATION INJURIES

Injuries Resulting from the Application of Electrophysical Treatment Methods. F. M. Groedel and Heinz Lossen. Strahlentherapie, 1931, XLI, 372-394.

The entire material collected in four medico-legal cases following the use of the quartz mercury vapor lamp, the sollux lamp, diathermy, and radium is published by the authors and should be looked up in the original by those interested in this subject.

ERNST A. POHLE, M.D., Ph.D.

The Problem of Total Body Exposure to Roentgen Rays. F. M. Groedel and Heinz Lossen. Strahlentherapie, Oct. 24, 1931, XLII, 532-538.

Total body exposure to roentgen rays has been suggested in the treatment of malignant tumors and was tried out recently in cases of leukemia and generalized skin disease. The danger of too high a total dose, because of the enormous absorption, is strikingly shown in a case seen by the authors. A man, 61 years of age, who had psoriasis involving almost the entire body, received exposures in numerous small areas distributed over a number of sittings. In a first series given in December, 1928, a total of 247 per cent H.E.D. was applied. In February, 1929, he received a total of 290 per cent H.E.D. In March, 1929, he received a total of 1,345 per cent H.E.D. In May, 1929, he received 1,830 per cent H.E.D. applied over thirty-seven areas. This brought the total dose given to the patient to about 38 H.E.D. During the entire time no blood examination had been made. Immediately following the last exposure an extreme anemia was observed and there were 2,350,000 red blood cells, 3,200 white blood cells, and 47 per cent hemoglobin. Under As and liver therapy combined with blood transfusions this typical aplastic anemia healed slowly. The importance of blood examinations during an extensive series of X-ray therapy is emphasized and a warning is issued concerning the dangers of excessive general body exposure.

ERNST A. POHLE, M.D., Ph.D.

Occupational X-ray Carcinoma. H. Yamakawa and K. Shimada. Gann, 1931, XXV, 1-4. (Reprinted from "Cancer Review" by permission.)

A man, 51 years of age, who had been employed in an X-ray laboratory for seventeen years had, ten years prior to being examined by the authors, noticed on the back of his hands a number of small warts which he treated with ointments. In 1926, a painful ulcer appeared on one of the warts, and as it did not heal, the finger (right index) was amputated. In July, 1929, an ulcer on the right middle finger was treated by amputation of the two terminal phalanges. Microscopic examination showed a deeply infiltrating medullary carcinoma of the anaplastic basal-celled type. Soon after this there appeared enlargement of the lymph nodes of the right elbow and axilla, which were removed in September. Shortly afterwards recurrence of the growth

appeared on the amputation scar of the right index finger, with enlarged right supraclavicular nodes and also a tumor in the right breast.

In April, the patient died, after having severe pain in the abdomen and right hip followed by paralysis of the right leg. At necropsy, metastases were found in the lymph nodes of the hilum of the right lung, heart, liver, pancreas, stomach, spleen, kidneys, left suprarenal, and appendix. The authors state that this is the first case of occupational X-ray cancer on record in Japan.

F. CAVERS, D.Sc.

The Danger of Roentgen Carcinoma Developing after Roentgenotherapy. H. Holthusen and K. Englmann. Strahlentherapie, Oct. 24, 1931, XLII, 514-531.

Carcinoma developing in irradiated areas has been reported; however, the percentage of incidence is very small. It seems that professional workers are much more in danger in that respect than a patient treated by irradiation. The authors relate the history of a man who, at the age of 26 years, received superficial roentgenotherapy because of sycosis barbæ. Immediately after the treatment he developed an acute reaction in the face, the neck, and upper chest. The epidermis underwent necrosis, and only eight months after the treatment complete epithelization had occurred. One year after the exposure he was treated because of skin necrosis in several areas in the neck. These healed, however, under radiation therapy (the type of radiation is not stated). Atrophy of the skin developed in the following years, which interfered greatly with the motion of the head, particularly with the function of the mandible during eating and talking. In 1924, a large ulcer appeared in the left cheek, which healed after from six to seven weeks. In 1929, a small growth developed on the right cheek. Though this growth dropped off, it recurred repeatedly. He returned for examination in June, 1929, and a diagnosis of roentgen carcinoma was made. Biopsy showed a typical squamous cell cancer. There was also a small gland in the right submandibular region. Radium therapy could not halt the process, but the growth increased in size, and broke through into the mouth until a hemorrhage from the temporal artery and subsequent pneumonia ended the patient's sufferings.

Thirty-nine cases collected from the literature are briefly quoted. An analysis of these shows that carcinoma develops most frequently in patients who have received several series of exposures. Head, vulva, and anus are more frequently involved. In conclusion, it is stated that the occurrence of a roentgen carcinoma following irradiation for therapeutic purposes is extremely rare. Since 1910, only three cases have been observed.

ERNST A. POHLE, M.D., Ph.D

The Treatment of X-ray Burns with Rays of Long Wave Length. W. Bröcker. Strahlentherapie, Oct. 24, 1931, XLII, 551-570.

Experiments showed that exposure to infra-red light applied before or after roentgen exposure does not influence the roentgen reaction of the human skin. In the animal experiment a prophylactic effect of infra-red rays toward roentgen injuries could not be proved. A roentgen ulcer appeared, regardless of infra-red exposure being applied before or after roentgen irradiation. Clinical experience has shown, however, that infra-red light is of value in treating already existing roentgen burns. Two cases are reported, the X-ray injuries of which healed following exposure to infra-red light, although all other therapeutic measures had failed to bring relief.

ERNST A. POHLE, M.D., Ph.D.

RADIUM

Radium and Microglia. Desiderio Perotti. Riv. di radiol. e fisica med., December, 1931, IV, 175-178.

The author inserted under the skull of rabbits a tube of 10 mg. radium element filtered with 1 mm. platinum and left it in place in one animal for 48 hours, in another for 108 hours. He found the changes produced by this method of irradiation were quite similar to those produced by the X-ray. There was a heaping up of microglia cells in the white submeningeal layer of the cortex. This, the author thinks, is due to the larger dose of radiation received by the submeningeal layer in comparison to that received by the deeper layers distant from the radium-bearing tube.

This accumulation of microglia cells, whose phagocytic power is evident where the radiation is most intense, seems to be of much importance in the regression and cure of cerebral tumors treated by radiotherapy.

E. T. LEDDY, M.D.

Plastic Apparatus Made from Reinforced Paraffin-wax ("Gammaplast") for Use in Superficial Radium Therapy. Gian Giuseppe Palmieri and Giovanni Paltrinieri. Riv. di radiol. e fisica med., December, 1931, IV, 150-174.

The authors discuss the use of "gammaplast," first described by them in 1929, as used in moulded applicators in the Radium Institute of Bologna. This technic avoids the main drawbacks found in the usual plastics, such as brittleness, great weight, difficulty of moulding to exactly fit the lesion, and expense of preparation of the "moulage." Numerous photographs illustrate the preparation and clinical applications of the authors' devices.

E. T. LEDDY, M.D.

A Method of Anchoring Radium Needles in the Pharynx. J. E. G. McGibbon. British Med. Jour., May 16, 1931, No. 3671, p. 843.

The technic described below has been adopted to overcome the difficulties encountered due to involuntary swallowing movements, hawking, and coughing.

In all previously described methods the needles have either been sutured in position, or the threads brought out through the mouth. In this method the needles are inserted in the usual manner through healthy tissue around the lesion, and the threads are left some ten inches in length. After insertion of a needle, its thread is secured outside the mouth, without any tension, by pressure forceps. When the requisite number of needles has been introduced a soft rubber urethral catheter, lubricated with liquid paraffin, is passed along the floor of one nasal fossa into the nasopharynx. As soon as the tip of the catheter is seen below the soft palate it is caught by a pair of forceps and brought outside the mouth. Half the total number of radium needle threads are then released from the pressure forceps and tied securely to the end of the catheter. The catheter is now carefully withdrawn from the nose, and immediately the attached threads appear at the nasal orifice, they are freed from the catheter. Each thread is gently drawn taut, and during traction, observation must be kept on the site of insertion of the attached needle in order to prevent accidental withdrawal. These threads are then tied together with a piece of silk or catgut. The lubricated catheter is now passed through the other nasal fossa, and the remaining free threads are dealt with in a similar manner. Finally, the two bundles of threads are tied securely together across the columella and the redundant ends cut off.

This method can be used successfully for lesions affecting the tonsil alone; the soft palate alone; the tonsil and palate; the tonsil and side of the tongue; the tonsil, palate, and side of the tongue, and the posterior pharyngeal wall.

Nasal respiration, speech, and swallowing are not interfered with, and the patient can take ordinary soft food up to the fifth day. From the fifth to the eighth day, when the needles are removed, only liquids may be taken.

Needles 21.7 cm. in length (active length 10 mm.), 1.65 mm. external diameter, containing 1 mg. of radium screened by 0.5 mm. platinum, have been found most convenient for use in the regions discussed above.

WALLACE D. MACKENZIE, M.D.

On External Radium Treatment in Gastro-intestinal Ulcers and in Their Post-operative Symptoms. Fritz Dautwitz. Strahlentherapie, Oct. 3, 1931, XLII, 219-248.

During the years from 1912 to 1929, the author treated twenty-five cases with gastro-intestinal symptoms which led to a diagnosis of either ulcer or carcinoma by external radium application. A fractional dose method was used, giving exposures daily or every other day. A series consisted of from four to eleven treatments of from eight to nine hours each and from one to three series were applied. The radium was filtered through 1.5 mm. lead and was usually given through three anterior and two posterior fields. The dose varied between 2,000 and 13,700 mg.-hrs. radium element. No other medication was given nor a special diet prescribed, in order to study the efficacy of the irradiation alone. There were seven cases of gastric ulcer, three of pyloric ulcer, three cases of questionable ulcer, six of duodenal ulcer, one of pylorospasm, one of hyperacidity, three of gastric and one of pyloric carcinoma. In only one case was there no response, while in four others, three of which had been operated on after radium treatment, no permanent cure could be obtained. All the remaining seventeen were benefited by the treatment, although surgical procedures had not given them definite relief from their symptoms. There follows then a lengthy discussion of the possible mechanism of the effect of irradiation on gastro-intestinal ulcers. Briefs of the twenty-five case histories are also appended. The author recommends this method for trial on a large number of patients.

ERNST A. POHLE, M.D., Ph.D.

Radium Treatment of Cancer of the Mouth. A. Santoro. Radiol. Med., January, 1931, XVIII, 115-128. (Reprinted from "Cancer Review" by permission.)

This is a report, with clinical histories, of eighteen cases treated for from four to twenty months. Clinical cure is claimed in twelve cases (though, of course, all are much too recent to be worth reporting). The technic varied according to the site of the tumor (contact application, external radiation with wax-modelled applicators, needling, combinations of these with X-rays, and diathermo-coagulation).

F. CAVERS, D.Sc.

Radium in the Treatment of Carcinoma of the Uterine Cervix. W. Neill. Med. Jour. and Record, 1931, CXXXIV, 74-76. (Reprinted from "Cancer Review" by permission.)

The value of radium treatment for carcinoma of the cervix is now well known and the results obtained in both early and advanced cases are superior to those of any other treatment. The efforts of the American Society for the Control of Cancer have undoubtedly accomplished something towards the education of the public as regards the early symptoms of this disease. Before radium treatment is commenced a very careful examination should be

made. A blood-count and Wassermann reaction should be done and a renal efficiency test carried out. In many cases of carcinoma of the cervix, death is due, not to cachexia, but to complicating uremia. Biopsy is also indicated in all cases. According to the author it is not an operation tending to cause dissemination of the disease.

The following classification is used: (1) The growth is early when it is limited entirely to the cervix; (2) The growth is borderline when, in addition to the cervix, it involves an adjacent vaginal wall or parametrium, but is still freely movable on bimanual palpation; (3) The growth is advanced when there is extensive fixation on one or both sides; (4) Recurrences after operation. Using this classification, cures by surgery can be expected only in the first group, there being an operative mortality varying from 11 to 18 per cent. Using radium, the author has had no primary mortality and has had 50 per cent five-year cures in Group 1, 31 per cent five-year cures in Group 2, 9 per cent five-year cures in Group 3, and 10 per cent five-year cures in Group 4. In most of the cases under observation for less than five years there has been considerable amelioration of the disease. The author has been unable to establish any definite relationship between the histology of the growth and the response to radiation.

The author does not give his technic in detail, but he prefers radium emanation to radium salts. He does not advocate intra-uterine radiation as he fears the risk of slough and infection in the uterus. His radium containers are held around the growth by gauze soaked in water. Very large doses are given (from 3 to 4 curie hours in a single dose), so that the treatment is completed in from one to two hours. Parametrial nodes are treated by implantation with gold seeds. Hysterectomy following radiation is not advisable and the use of X-rays to the pelvis after local radium treatment does not appear to alter the prognosis. X-rays should be used only in the advanced cases as a palliative.

P. J. Kerley, M.B.

Radium Injuries to Bladder and Rectum in Treatment of Cancer of Uterine Cervix. F. C. Wille. Monatschr. f. Geburtsh. u. Gynäkol., August, 1930, LXXXV, 383-390. (Reprinted from "Cancer Review" by permission.)

The author doubts whether or not radium is often responsible for early radium injury to the bladder, because cystitis is common in advanced cancer of the cervix. The late results attributed to radium are of two kinds: greyish patches (also occurring sometimes after operation when the bladder has been freed from the adjacent tissues) and ulcers with a surrounding area of bullous edema (also at times seen in non-irradiated cases in which there is commencing invasion of the bladder wall by the growth, *i.e.*, a stage in perforation of the bladder).

The author describes ten cases of fistula (five vesicovaginal, three rectovaginal, two a combination of these), apparently attributable to repeated treatments rather than to single large doses. The fistulas developed within a year at most after the last treatment. These cases occurred between 1915 and 1928, during which time 386 cases were treated with radium. The author believes that with the method now used at the Charité, in which a total dosage of from 3,000 to 3,600 mg.-hrs. is given in two sittings with an interval of eight days, these injuries will be less frequently seen.

F. Cavers, D.Sc.

Chemical Changes Produced in Malignant Tissue by Radium Radiation and the Importance of These Changes in the Treatment of Cancer. J. Flaszen and H. Wachtel. Bull. Assn. franç. p. l'etude du Cancer, January, 1931, XX, 18-30. (Reprinted from "Cancer Review" by permission.)

The authors, having observed in certain cases of cancer treated by radium a very early reaction without any latent period, have investigated the question of chemical changes produced at the site of irradiation. They have discovered what they term a "histolytic action," provoked mostly by the beta rays of radium, which leads to a modification of the power of the malignant cells to resist destruction by the protective processes of the body. This results in an immediate decrease in the size of the malignant tumor and even, in some cases, to a complete local cure of the condition before the expiry of the latent period which precedes the appearance of effects due to the gamma rays.

C. E. Dukes, M.D., M.Sc.

ROENTGEN RAY (INDUSTRIAL APPLICATION)

Radiographic Inspection of Metals. Herbert R. Isenburger. Mech. Eng., 1931, LIII, 729-735.

The relative value and application of X-rays and γ-rays for the inspection of metals are discussed. The X-rays are used for industrial purposes. The equipment is described and the various defects of castings and welds are demonstrated and explained by means of photographs. For very heavy material of more than 3 in. thickness, γ-rays should be used, because they are more penetrating. They also give finer details in thinner materials. The operating cost with X-rays amounts to from $3.00 to $5.00 per hour, depending on the way in which the material is writ-

ten off. Radiographic inspection costs about the same when the radio-active material is rented.

CHEMICAL ABSTRACTS.

The Use of X-rays in Petrography of Bituminous Coal. H. Winter. Glückauf, 1931, LXVII, 1105-1111.

The nature and distribution of ash in pulverized coal are shown by the roentgen-ray method. An improved procedure is described in which an ionization chamber and gold leaf electroscope are used. Means are provided for accurate standardization of the ionizing current, and instantaneous readings of the rate of discharge of the electroscope are obtained by means of a Siemens charge meter. Since the nature of the ash in coal affects the degree of penetration of the rays, accurate determination of the amount of ash present is possible only when its chemical composition varies only slightly from sample to sample as is the case with different samples of coal from the same mine.

CHEMICAL ABSTRACTS.

SINUSES (DIAGNOSIS)

Further Studies in the Use of Iodized Oil (Lipiodol) in the Diagnosis of Maxillary Sinus Disease, with a Report of 225 Cases. E. L. Whitney and H. P. Doub. Jour. Michigan St. Med. Soc., February, 1931, XXX, 72-77.

In the borderline cases, iodized oil is of greatest value in determining the type and extent of the pathology, in ascertaining anatomic variations.

With the patient in upright position, under anesthesia with 10 per cent cocaine, sinuses are injected using a 16 gauge needle for the puncture. Lipiodol is diluted with two parts petrolatum. After injection, until the oil is seen returning over the inferior turbinate, a moist piece of cotton is placed in the region of the inferior meatus and the patient sent to the X-ray Department, where films are made in all the standard positions, with progress films to check the emptying time. In the normal antrum, the opaque shadow will be the size and shape of the bony contour of the sinus; pathologic variations shown will be thickened membrane, polyps, and other tumor growths. The emptying time is being given increasing attention.

Lipiodol examination agreed as to the presence of pathology in 96 per cent of the operated cases, while sinus washing was dependable in only 56 per cent.

W. W. WATKINS, M.D.

The Radiography of the Accessory Nasal Sinuses: A New Standardized Technic for the Exact Projection of All the Accessory Nasal Sinuses, Together with the Demonstration of Fluid Levels. H. Graham Hodgson. Brit. Jour. Radiol., September, 1931, IV, 421-431.

Since the use of "nose-chin" or "forehead-nose" positions obviously will not give constant relationship of various bony landmarks of the skull in sinus radiography, the author has resorted to the use of a specially constructed upright head clamp attached to a vertically mounted Bucky diaphragm. A large metal protractor is used for obtaining constant angles between the central ray from the tube and the orbito-meatal line.

Six positions are routinely used: (1) The occipito-frontal, with the orbito-meatal line perpendicular to the film and the rays centered over the external occipital protuberance (petrous bones thrown into orbital spaces, hence projection closely simulates the Granger position) for maxillary sinus study; (2) the occipito-mental, with the head tilted backward 45 degrees, which throws the petrous bones inferior to the antra and shows the anterior ethmoid cells projected above the posterior ethmoids; (3) the vertico-mental view, with the head tilted back to the maximum and the tube now tilted downward so that the central ray will pass exactly vertically through the vertex of the skull, for sphenoid study; (4) and (5) the right and left oblique views, with the head tilted backward 39 degrees and rotated 39 degrees to right and left, thus projecting the posterior ethmoids into the corresponding maxillary sinus, and (6) the simple true lateral.

By making all examinations with the patient sitting up, low fluid levels in the antra can be readily identified which might be entirely missed with the patient in the prone posture. (Of such cases, 5 per cent may be clinically normal antra, in the author's experience.)

J. E. HABBE, M.D.

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